eries
e

Handbook of Hedge Funds

François-Serge Lhabitant

John Wiley & Sons, Ltd

mation or specific reporting re-

f there is an adverse change in
eement or the private placement
nagement fee), this change will

a term stating that redemption
-in-kind, and within a certain
set out in the private placement

more common, investors have
onditions than those provided
ation status is ensured that no
ble terms for investing unless

increasingly common, several

obligation by the hedge fund's
f the answer is positive, then
hedge fund owe an identical
reate a separate class of shares
Otherwise, the directors of the
ersonally liable for the losses

and in particular, how can one
terms of several different side
idual side letters are tracked,

ors have received preferential

ndicate that the hedge fund's
ger should attempt to address
ive manner, e.g. by building

side letters are also useful,
equirements that may not be
any detonation, hedge fund
ure that their side letters are

5
Understanding the Tools Used by Hedge Funds

Give me a lever long enough and a place to stand and I will move the world

Archimedes

Before going into detail about the various hedge fund strategies, we believe that it is useful to introduce the basic tools used by hedge funds to implement their trades, namely, buying, selling, short selling, buying on margin, using derivatives and leveraging. Several of these tools are not used in the traditional investment world, which explains why people often have trouble understanding them, or perceive them to be extremely complicated and/or purely speculative. In this chapter, we will therefore cover the basic mechanics and rationale of each of these tools and provide a good understanding of the subject-matter.

5.1 BUYING AND SELLING USING A CASH ACCOUNT

The key to successful investing – buy low and sell high – is one of the oldest pieces of investment advice on record. It sounds so simple that one could hardly argue with it. In terms of operations, the strategy involves two basic transactions, *buying long* and *selling* at a later date, hopefully at a higher price. Its profit simply equals the difference between the sale price and the purchase price.

Buying long is the most common strategy, at least from an individual investor's perspective. A hedge fund buying long has some cash and simply exchanges it for the security that it wants to hold. In a sense, the transaction can be represented as a swap (see Figure 5.1). Once the transaction has been concluded, the hedge fund has no further commitment. It fully owns the security and enjoys all its benefits (dividends, coupons, voting rights, etc.).

Selling is simply the opposite of buying long. A hedge fund wanting to sell a security that it no longer wishes to hold exchanges it for cash (see Figure 5.2). Once the transaction has been concluded, the hedge fund has no further commitment. It fully owns the cash, and can use it for any purpose.

Buying long and selling are called *cash transactions*, because they do not involve any loan and do not require any collateral. All the flows take place at the same time, and do not involve any future commitment. By contrast, other transactions are based on some form of lending and therefore require the posting of collateral and repayment of the loan. In this case, a securities company – typically a brokerage firm – will lend some securities or some cash to the hedge fund and will hold other assets in the fund's account as collateral for the loan. The collateral in this case is termed *margin* and can be made up of cash, securities or other financial assets.

The two major transactions requiring collateral are *buying on margin* and *selling short*. Both are usually confusing for neophyte investors. While conventional security transactions involve only two parties, the buyer and the seller, margin transactions involve a third party, the security

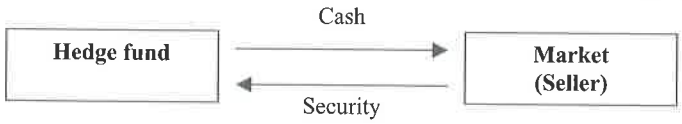


Figure 5.1 Flows resulting from a long buy operation

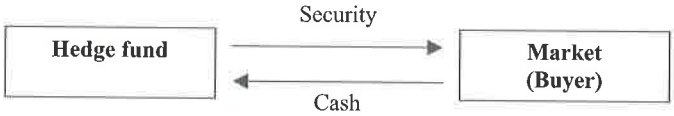


Figure 5.2 Flows resulting from a sell operation

lender. This is because both buying on margin and selling short imply borrowing an asset. When buying on margin, the hedge fund borrows some cash; when selling short, the hedge fund borrows a security. In the following, we attempt to clarify the differences between these two strategies by looking at the detailed flows they generate.

5.2 BUYING ON MARGIN

5.2.1 Mechanics

Simply stated, a hedge fund buying on margin has no cash, but would like to buy a security that it expects to appreciate in the future. It therefore borrows some money from a broker and exchanges it for the security. Naturally, the broker will ask for some kind of collateral to secure the loan (see Figure 5.3).

Later, once the hedge fund has enough cash and no longer needs the loan, it will pay it back with interest, and receive back its collateral. The cash may come from the sale of the security that was bought on margin, or from any other source (see Figure 5.4).

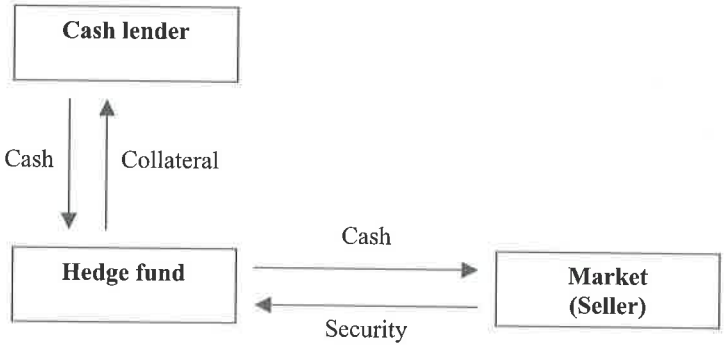


Figure 5.3 Flows resulting from initiating a buy on margin transaction

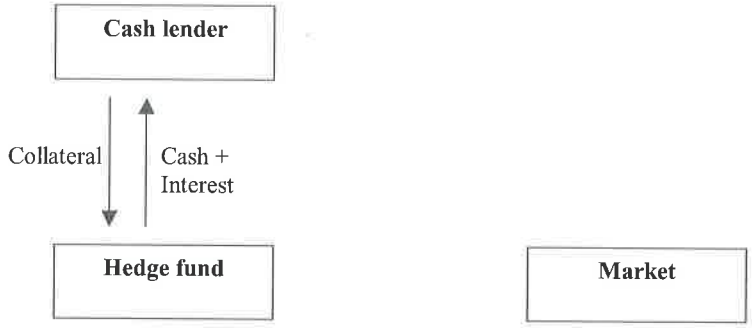


Figure 5.4 Flows resulting from closing a buy on margin transaction

There are several reasons for a hedge fund to buy on margin. First, buying on margin is an efficient way of borrowing against the securities already held in a portfolio, using them as collateral. The proceeds of such a loan can be used for both investing and non-investing needs. The interest rate charged is usually lower than in bank loans, and the repayment terms are much more flexible. Second, buying on margin increases the buying power and allows a greater amount of securities to be purchased per dollar of capital (i.e. leverage). Indeed, a fund manager buying on margin does not need to fully pay for his purchase – he just needs to post some collateral. With little cash or even no cash, it is therefore possible for him to take a position and enjoy its rise in price without really paying for it.

Brokerage firms also find several advantages in margin trading. They make money on both the margin accounts (from the interest they charge on the loans) and the trading (from the higher commissions they receive, due to the larger transaction sizes that leverage allows). Since margin loans are always secured by collateral, the default risk of a borrower is relatively limited. Indeed, the only risk is that the collateral plus the securities held in the margin account decline in value to a point where they are worth less than the loan balance itself. This raises two new questions. First, which type of collateral should be accepted? Second, how can one prevent the value of the collateral from dropping below the balance of the loan? To answer these questions and to prevent the excessive use of credit to purchase securities, most regulatory bodies and exchanges have enacted rules that govern margin trading. Whatever the country, these rules should cover three dimensions: minimum margins, initial margins and maintenance margins.

To open a margin account with a broker and before any trade takes place, an investor must deposit a *minimum margin*. This rule primarily targets small investors; it is not really relevant to hedge funds, because the corresponding amount is small. For instance, in the United States, the National Association of Securities Dealers (NASD) and the New York Stock Exchange (NYSE) now impose a minimum of $25 000 in cash or fully paid securities in order to open a margin account.[1] Of course, amounts differ in other countries and markets.

The *initial margin* requirement represents the minimum amount of funds an investor must put up to purchase securities on credit. For example, with a 50% initial margin requirement,

[1] Note that this amount used to be only $2000 in the early days of electronic trading.

the maximum amount of credit an investor can obtain from his broker to purchase stocks is 50% of the stocks' value. An investor willing to buy one share of common stock valued at $100 per share must do so with at least $50 of his own funds or additional collateral.

In the US, the Federal Reserve sets the initial margin requirement as part of its monetary policy. Since 1934, it has changed 23 times, and even at one time reached a full 100% payment. The current rate, set in 1974, is 50%. As a matter of comparison, the initial margin requirement in the 1920s was usually around 10%. It resulted in high levels of margin debt and unstable stock prices, and created perfect conditions for the stock market crash in 1929.

The *maintenance margin* represents the minimum amount of funds an investor must have on his margin account to maintain an open position. It is expressed as a fixed percentage of the total market value of the securities held on margin. For instance, in the US, the NASD and the NYSE impose a minimum 25% maintenance margin requirement on their customers.

The positions purchased on margin are marked-to-market each day, which results in their regular revaluation. The gains, or losses, associated with the daily price changes are applied to the margin account. If the value of the margin account falls below the maintenance margin, the hedge fund receives a *margin call*. This is basically a request to deposit additional collateral. The fund manager can respond either by selling a part of his open position to reduce his exposure, or by depositing additional cash and/or new securities, until the maintenance margin requirement is met. The cash transferred due to a margin call is referred to as the *variation margin*.

Of course, security lenders prefer having a collateral made of stable assets, such as cash or T-bonds, while hedge funds prefer using risky securities (including the shares they purchased on margin) to secure their loans.[2] Most of the time, security lenders use a *haircut table*, which defines those securities that are accepted as collateral and the rule to determine their marginable value (usually a percentage of the market value). The riskier the asset considered, the more severe the haircut – for instance, cash and T-bills are usually taken at 100% of their value, while a diversified portfolio of stocks may only be accepted at 50 to 70% of its value.

Regulators may change the minimum margin rules whenever market conditions justify it. Brokerage houses must follow these rules, but they may freely apply more stringent requirements to their clients if they want to. In practice, most brokers officially request higher margins than the minima set by regulators and exchanges, but they may further differentiate their margin requirements and haircut tables by individual stocks and by the trading behaviour and credibility of their customers.

5.2.2 Buying on margin: an example

Let us now illustrate the mechanisms of buying on margin. Consider the case of a hedge fund buying on margin 10 000 shares at $10 each. Its broker applies the 50% initial margin and the 25% maintenance margin requirements.

The current market value of the purchase is $100 000. In accordance with the 50% initial margin requirement, the hedge fund would need to deposit collateral or safe securities worth $50 000 into its margin account. The broker would lend the remaining $50 000 and execute

[2] In the US a few securities cannot be used as collateral, e.g. penny stocks (stocks trading below $5), initial public offerings (not marginable for 30 days), mutual funds held for less than 30 days, securities held in a retirement account, and securities held in a custodial account.

s broker to purchase stocks is
e of common stock valued at
additional collateral.
ement as part of its monetary
reached a full 100% payment.
the initial margin requirement
s of margin debt and unstable
t crash in 1929.
f funds an investor must have
ssed as a fixed percentage of
nce, in the US, the NASD and
ement on their customers.
ch day, which results in their
y price changes are applied to
v the maintenance margin, the
deposit additional collateral.
open position to reduce his
until the maintenance margin
s referred to as the *variation*

stable assets, such as cash or
ing the shares they purchased
ers use a *haircut table*, which
to determine their marginable
e asset considered, the more
aken at 100% of their value,
0 to 70% of its value.
market conditions justify it.
pply more stringent require-
cially request higher margins
urther differentiate their mar-
y the trading behaviour and

der the case of a hedge fund
e 50% initial margin and the

rdance with the 50% initial
eral or safe securities worth
aining $50 000 and execute

below $5), initial public offerings (not
ment account, and securities held in a

the purchase transaction. The hedge fund account would then appear as follows:

Assets		Liabilities	
Long stocks	100 000	Debit balance	50 000
		Equity	50 000

The debit balance consists of the amount due to the broker, plus interest on this loan amount, while equity is defined as the difference between the current market value of the long stocks and the debit balance. The fund's equity covers exactly 50% of the market value of the stocks held long. The basic accounting equation is:

$$\text{Equity} = \text{Assets} - \text{Liabilities}$$

For margin investing, this equation changes slightly to:

$$\text{Equity} = \text{Market value of long stocks} - \text{Debit balance}$$

The equity will therefore change as the current market value of the long stocks rises and falls and as interest is added to the debit balance. For the sake of simplicity, let us ignore interest and focus on stock price movements.

If the stock price goes up, say to $12, the value of the assets will increase to $120 000. On the liability side, the corresponding gain would be credited to the fund's equity. The fund's equity would then cover 58.33% (70 000/120 000) of the market value of the stocks held long. The hedge fund account would appear as:

Assets		Liabilities	
Long stocks	120 000	Debit balance	50 000
		Equity	70 000

If the stock price goes down, say to $8, the value of the assets will decrease to $80 000. On the liability side, the corresponding loss would be attributed to the fund's equity, which would fall to $30 000. The fund's equity would then cover 37.5% (30 000/80 000) of the market value of the stocks held long, which is still acceptable since it is above the minimum maintenance margin. The hedge fund account would appear as follows:

Assets		Liabilities	
Long stocks	80 000	Debit balance	50 000
		Equity	30 000

To trigger a margin call, the value of the hedge fund's equity needs to equal 25% (the maintenance margin) of the value of open positions. The corresponding threshold stock price can be calculated as:

$$\text{Equity} = (\text{Long stock value} - \text{Debit balance}) = 0.25 \times \text{Long stock value}$$

That is:

$$(10\,000 \times \text{Stock price} - 50\,000) = 0.25 \times 10\,000 \times \text{Stock price}$$

Solving yields a stock price equal to $6.6667. If the stock price reaches this threshold value, the hedge fund account will appear as follows:

Assets		Liabilities	
Long stocks	66 667	Debit balance	50 000
		Equity	16 667

The fund's equity then covers exactly 25% (16 667/66 667) of the market value of the stocks held long. Any additional drop in the stock price would further reduce the equity value, leading to insufficient coverage of the position. The broker would have to issue a margin call – a request to increase the amount of equity.

As an illustration, let us say that the stock price falls to $6 per share. The hedge fund account appears as follows:

Assets		Liabilities	
Long stocks	60 000	Debit balance	50 000
		Equity	10 000

If the fund decides to respond by depositing an additional amount of $5000 in its margin account, the cash deposit will be applied against the debit balance. The new account status will look like this:

Assets		Liabilities	
Long stocks	60 000	Debit balance	45 000
		Equity	15 000

The equity finances exactly 25% of the long stock position. However, any subsequent decrease in the stock price will prompt a new margin call from the broker. It would therefore be safer for the fund manager to deposit an amount larger than $5000, or to liquidate some shares to reduce its exposure.

Note that if the hedge fund manager ignores the margin call or is not reachable, the broker is entitled to protect his interests without prior notice and bring the equity coverage into an acceptable range by selling a portion of the long stock position. The fund manager has no right to control such liquidation decisions. For instance, in the case of a diversified portfolio, the broker can freely decide which securities among the ones collateralized will be sold. The fund will be held responsible for any losses incurred during this process.

5.3 SHORT SELLING AND SECURITIES LENDING

Short selling – selling something that you do not own yet – is neither very complex nor entirely simple. Nevertheless, it is a concept that many investors have trouble understanding and its practice is among the most controversial activities on financial markets. Since it benefits from falling prices, short selling is regularly criticized, particularly during times of crisis or following major price declines. The general idea seems to be that short selling is malevolent, morally wrong, and even against the word of God (Proverbs 24:17: "Do not rejoice when your enemy falls, and do not let your heart be glad when he stumbles."). However, as we will see in this section, reality is not that sombre, and short sellers also provide markets with important

ce reaches this threshold value,

50 000
16 667

the market value of the stocks
educe the equity value, leading
o issue a margin call – a request

share. The hedge fund account

50 000
10 000

nount of $5000 in its margin
e. The new account status will

45 000
15 000

ever, any subsequent decrease
r. It would therefore be safer
r to liquidate some shares to

r is not reachable, the broker
the equity coverage into an
he fund manager has no right
of a diversified portfolio, the
alized will be sold. The fund
ss.

ES LENDING

s neither very complex nor
have trouble understanding
ial markets. Since it benefits
rly during times of crisis or
short selling is malevolent,
: "Do not rejoice when your
. However, as we will see in
ide markets with important

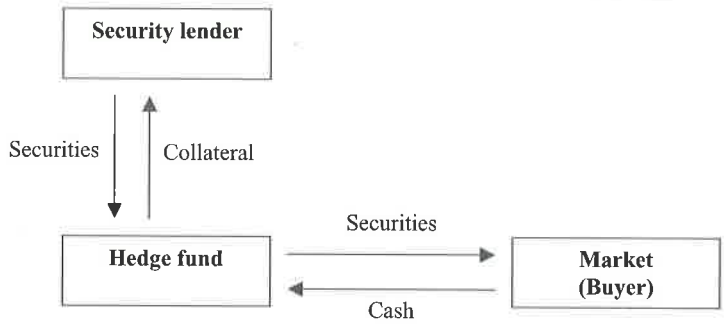


Figure 5.5 Flows resulting from initiating a short sale transaction

benefits. Moreover, short selling is now a key tool used by hedge funds, but it is also a long-standing market practice for other market participants such as market makers, broker–dealers and investment banks. In order to understand market reactions, it is therefore necessary to understand how short sellers operate.

5.3.1 Mechanics of short selling

Although short selling is commonly considered as one transaction, it really consists of a series of basic operations.

- The hedge fund sells a given number of securities that it does not yet own.[3] The buyer of the securities is not aware that this is a short sale, but the short seller needs to make arrangements to cover his delivery obligations before they fall due. Note that in some instances short sellers make no delivery arrangements, either before or following the normal settlement date, and let the open position run as long as market rules allow or until the market or settlement system takes action to close the position out (Figure 5.5).
- The hedge fund borrows the same number of securities from a security lender and contracts to retransfer an equivalent number of the same securities at some point in the future to the lender. The security lender receives a daily fee from the hedge fund, which is a function of supply and demand for the borrowed securities. In addition, the hedge fund has to put up collateral to provide the lender with a perfected security interest until the securities are returned. This collateral can be either in cash or other acceptable securities, to at least the value of the securities borrowed.
- The hedge fund delivers the securities to the buyer with full legal ownership, including voting rights. The sale proceeds are credited on the hedge fund account.
- At some later date, the hedge fund will repurchase the same number of securities from the market.
- The purchased securities will be returned to the lender. The short position is then closed (see Figure 5.6).

[3] In some cases, the hedge fund may have already borrowed the necessary securities before selling them short.

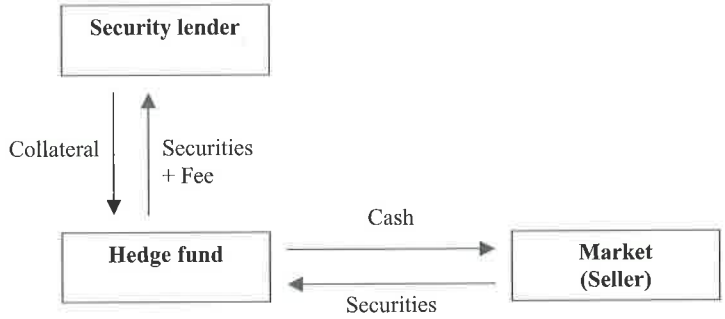


Figure 5.6 Flows resulting from closing a short sale transaction

To introduce some terminology, as soon as the stock has already been borrowed or is known to be available at the time of sale, the transaction is commonly called a *covered short*. If the seller does not *yet* own the stock he is selling and has made no provision to borrow or otherwise provide for delivery of stock to the purchaser by the settlement date, the transaction is referred to as a *naked short*. If shares are not found by the time the transaction must be settled, there is a *failure to deliver* shares to the buyer.

Note that a huge increase in naked short selling could create a virtually unlimited quantity of shares, even to the point that a normal market based on supply and demand could be seriously distorted. One of the arguments frequently used against naked short selling is that brokers and dealers accommodate stock price manipulation by permitting naked short sales to occur when there is no possibility of actually delivering shares to the buyers. However, naked short sales are not always associated with an attempt to manipulate prices. In fact, they can even sometimes protect investors from price manipulation. For instance, market makers such as intermediaries on the NYSE or the Nasdaq may choose to sell short if there is a sudden but temporary series of buy orders on a stock with no real fundamental justification. Their short sale will avoid an unjustified run-up in the stock's price and stabilize the market.

During a short sale operation, the securities lender has in essence turned his security position into cash while still retaining the economic benefits of ownership. This implies that there are in fact two positions to consider when analysing a short sale: a "real" position occupied by the buyer of the security sold short, and a "phantom" position held by the entity lending the security to the hedge fund. As a consequence of the phantom position, the hedge fund is responsible for any corporate action with respect to the stock lender. For instance:

- If the corporation whose shares are held short pays a dividend, the hedge fund must pay the amount of the dividend to the stock lender.
- If the corporation whose shares are held short splits two-for-one, the hedge fund owes the lender twice as many shares.
- If the corporation whose shares are held short spins off, the hedge fund is short two securities: the original security and the spin-off security.
- If the corporation whose shares are held short makes a rights offering, the hedge fund must go into the marketplace and deliver the rights to the stock lender.

Technically, short selling does not require any initial investment – it just requires finding a security lender and having enough collateral. Nevertheless, short selling involves

important risks:

- A *market risk*. Short sellers must buy back an equivalent number of the same securities that were sold. They are therefore exposed to the risk of the price of shorted securities rising rather than falling.
- A *recall risk*. Borrowed securities may be recalled at any time by the lender. If the short seller is unable to find an alternative lender, he will be forced to close his position and repurchase the securities in the open market at any price. This is called a short squeeze, or a market corner (see Box 5.1).
- A *liquidity risk*. With less liquid securities, the market may dry out and the sort seller may be unable to find securities to buy, making it difficult for him to close out his positions.

Box 5.1 Examples of early short squeezes

The oldest short squeezes in the US date from the 19th century and involved well-known industry barons, in particular Cornelius Vanderbilt and Daniel Drew.[4] For instance, the first Harlem Corner (Figure 5.7) occurred in 1863, when Vanderbilt bought stock in the Harlem Railway Company at around $8 to $9 a share and the New York City Council passed an ordinance allowing him to build a streetcar system the length of Broadway. The stock rallied to $75, but Daniel Drew conspired with members of the Council to sell the stock short, repeal the ordinance, and thus force the price down. Vanderbilt secretly bought the entire stock of the company, and forced short sellers to settle at $179 per share after the repeal of the ordinance.

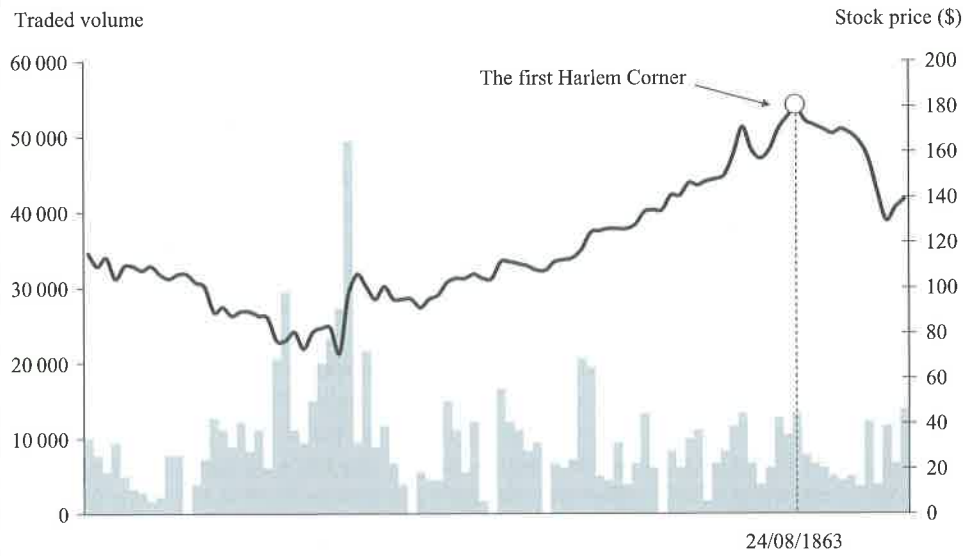


Figure 5.7 Stock price (black curve, right hand scale) and volume chart (grey shade, left hand scale) of the first Harlem Corner

[4] See for instance Allen and Gale (1992) or Chancellor (2000).

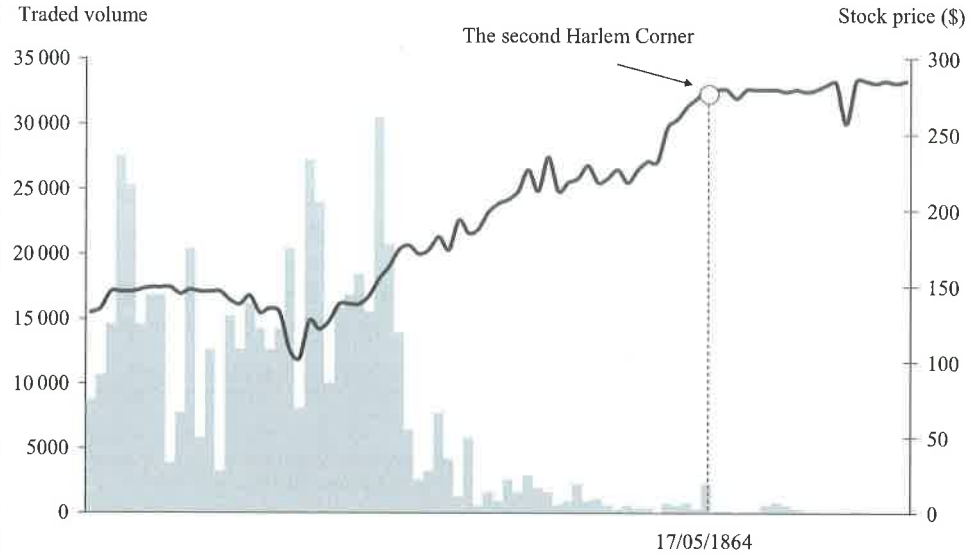


Figure 5.8 Stock price (black curve, right-hand scale) and volume chart (grey shade, left-hand scale) of the second Harlem Corner

Vanderbilt then decided to get authorization for his Harlem Railway extension directly from the New York State Legislature. Hoping for revenge, Drew conspired with the unwary state legislators, spread news about the likely passing of the legislation, pushed up the price of the Harlem Railway, then proceeded to sell the stock short, defeated the bill and forced the price down. The stock price dropped from $150 to $100 in two days. Vanderbilt bought more shares than were actually in existence and forced short sellers – including Drew – to settle at $285. This was the second Harlem Corner (Figure 5.8).

However, Vanderbilt was not always successful when fighting Drew. For instance, in March 1868, Vanderbilt was doing battle over the Erie Railroad Corporation – he was buying the shares while Daniel Drew and Jay Gould were short-sellers. At some point, Vanderbilt had bought more shares than were in existence, and thought he had won the battle. But Drew was a director of the company and surprised Vanderbilt by converting a large hidden issue of convertible bonds into common stocks and flooding the market with these new shares. This allowed him to cover his shorts and avoid the short squeeze.

Another famous example of a short squeeze occurred in spring 1901, as J.P. Morgan and a group of investors led by Edward Harriman fought for control of Northern Pacific Railroad (Figure 5.9). Harriman started by acquiring $40 million of the common stock, running just a few thousand shares short of gaining control, but J.P. Morgan went out to acquire the rest of the stock and his purchase sent prices soaring from $114 to $147 in five days. Noticing the unusual and unjustified increase in the stock price, a group of short sellers built a large short position. However, on 9 May, they realized that they could no longer cover their shorts and the price jumped from $170 to $1000 during the day. The volume traded was 3 336 000 for the day, a record not broken until 1925. Morgan and Harriman agreed to settle with the short sellers at $150 the next day.

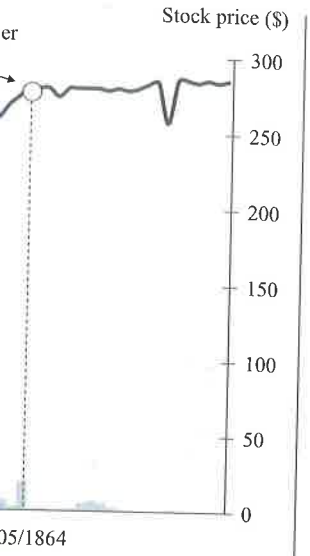


chart (grey shade, left-hand

ailway extension directly
conspired with the unwary
lation, pushed up the price
efeated the bill and forced
o days. Vanderbilt bought
ers – including Drew – to

g Drew. For instance, in
ad Corporation – he was
t-sellers. At some point,
thought he had won the
anderbilt by converting a
flooding the market with
the short squeeze.
901, as J.P. Morgan and a
Northern Pacific Railroad
nmon stock, running just
ent out to acquire the rest
47 in five days. Noticing
short sellers built a large
longer cover their shorts
me traded was 3 336 000
agreed to settle with the

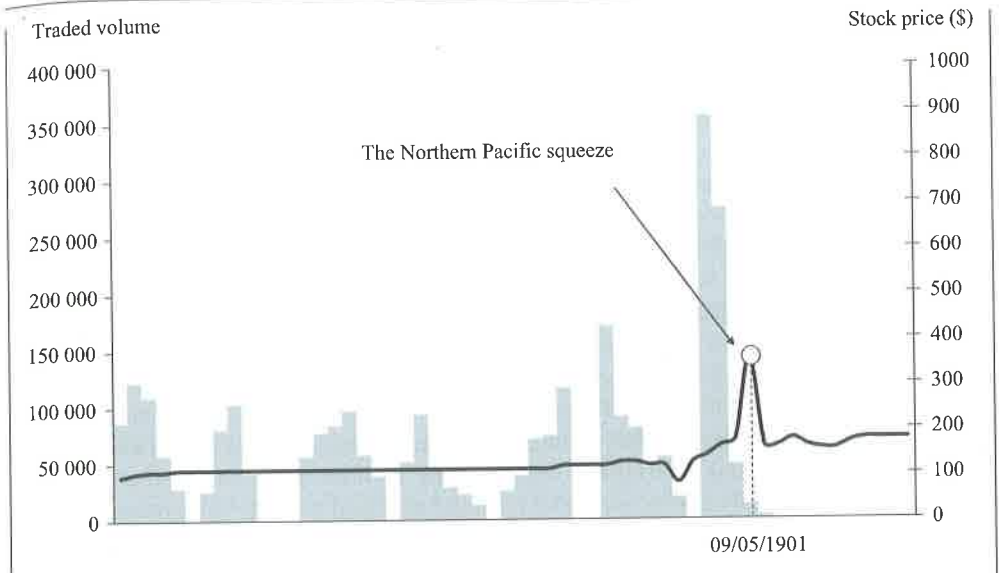


Figure 5.9 Price and volume chart of Northern Pacific around its short squeeze

The cost and difficulty of short selling is determined by supply and demand in the securities lending market. Generally, it is relatively easy to borrow most large cap stocks in established markets at a cost varying from 25 to 75 basis points per year. It is much harder to borrow securities that have low institutional ownership or that are in high demand for borrowing – typically the stocks many people believe to be overpriced. The cost may then increase dramatically, and the recall risk may be high. This leads to an interesting paradox: the securities lending market works well, except when everybody wants to use it to sell short, in which case it works very badly.[5] This paradox explains why most hedge fund managers do not want to disclose their short positions – the cost of borrowing securities rises when other investors are also trying to short.[6] A key indicator to monitor is therefore the *short interest*, i.e. how many shares have already been sold short. Last but not least, secrecy might be preferred if the short seller wants to avoid being sued or harassed by the firm he is currently shorting.

If we ignore all lending and execution costs, it should be clear that a hedge fund engaged in a short position will make money only if the repurchase price is lower than the original sale price; the hedge fund will incur a loss if the repurchase price is higher than the sale price. Consequently, the most obvious reason to short is to profit from an overpriced security or market. More sophisticated hedge fund strategies may also use short selling as a hedge for

[5] A good illustration of this phenomenon is the internet bubble period. D'Avolio (2002) studied data on loan supply, loan fees, and recalls from a large lending intermediary from April 2000 through September 2001. Although most stocks could be borrowed to sell short for a cost of no more than 20 basis points per year, about 9% of the stocks (called the "specials") had loan fees in excess of 100 basis points per year, and the most difficult stocks to borrow had loan fees in excess of 25% per year. D'Avolio also found the unconditional probability of recall to be about 1% for a particular day, 2% over a month and 18% over the entire 18-month period. The median time to reborrow the stock from another lender was nine days.

[6] The question of short sale and short position disclosure has been raised by regulators several times in the past. In the US, the Subcommittee on Commerce, Consumer and Monetary Affairs of the House Committee on Government Affairs held hearings on the market role of short selling and introduced a bill in 1990 that proposed requiring the public reporting of material short positions. The US Congress did not take any action on the bill.

other long positions with offsetting risk, or as a way to speculate on spreads, i.e. the difference between two securities, as we shall see in Part II of this book.

Short selling relies heavily on securities lending, i.e. the practice of security holders making their securities available for a small fee to sellers in the market, on condition that equivalent securities be returned to them at a future date. Securities lending existed in the US in the 19th century, but it only really gained momentum in the 1970s and 1980s with the liberalization of regulations that had previously hampered the practice. Today, available official data suggest that the US market size of open securities loan positions is close to $3 trillion.

The primary source of securities lending remains portfolios of beneficial owners, such as institutional investors, pension funds and insurance companies. These investors are willing to generate additional revenue on their long-term strategic holdings and they are motivated by the desire to reduce custody fees for their portfolios. Although the returns on securities lending are relatively small, particularly for the most liquid securities, a few basis points may matter in a field as highly competitive as asset management. The second source of securities lending is financial firms such as banks and broker–dealers acting as either agents on behalf of beneficial owners, or as principal. For them, securities lending has turned out to be a business in its own right, much more than an extension of a firm's basic inventory management process. Most broker contracts allow the lending of securities held in their margin accounts, and several firms even borrow securities in advance, with the expectation that others will shortly be prepared to pay more to borrow them (Box 5.2).

Box 5.2 Shorting and short squeezes

Before April 1932, US brokers could and did lend the shares of their clients without requiring their secure written authorization. The New York Stock Exchange announced the end of this practice on 18 February 1932, but most brokers were slow to request the necessary authorizations. This led to several memorable squeezes, in which share lenders were able to extract substantial concessions from borrowers. For instance, on 31 March 1931, US Steel (Figure 5.10) – generally the most actively traded issue on the NYSE and easy to borrow for shorting purposes – was loaned at a premium of ½% per day, i.e. an annualized cost of more than 180% per year to maintain a short position. These high premiums did not last for long, as brokers suddenly woke up and more shares became available for lending.

Regulation SHO

In the US, Regulation SHO was adopted by the SEC and came into effect on 3 January 2005. Its goal is to control the potentially manipulative effects of abusive naked short selling and extended fails-to-deliver of outstanding short positions. Among other things, Regulation SHO:

- Prohibits a broker–dealer from executing a short sale order for his own account or the account of another person, unless the broker–dealer: (i) has borrowed or entered into an arrangement to borrow the security; (ii) has reasonable grounds to believe that the security can be borrowed so that it can be delivered on the date delivery is due; and (iii) has documented compliance with this provision.

te on spreads, i.e. the difference

tice of security holders making
t, on condition that equivalent
g existed in the US in the 19th
980s with the liberalization of
available official data suggest
e to $3 trillion.
of beneficial owners, such as
These investors are willing to
s and they are motivated by the
returns on securities lending
few basis points may matter in
source of securities lending is
agents on behalf of beneficial
out to be a business in its own
management process. Most
in accounts, and several firms
rs will shortly be prepared to

eir clients without requiring
nge announced the end of
w to request the necessary
ch share lenders were able
e, on 31 March 1931, US
on the NYSE and easy to
per day, i.e. an annualized
These high premiums did
ares became available for

effect on 3 January 2005.
ve naked short selling and
other things, Regulation

r his own account or the
borrowed or entered into
ounds to believe that the
late delivery is due; and

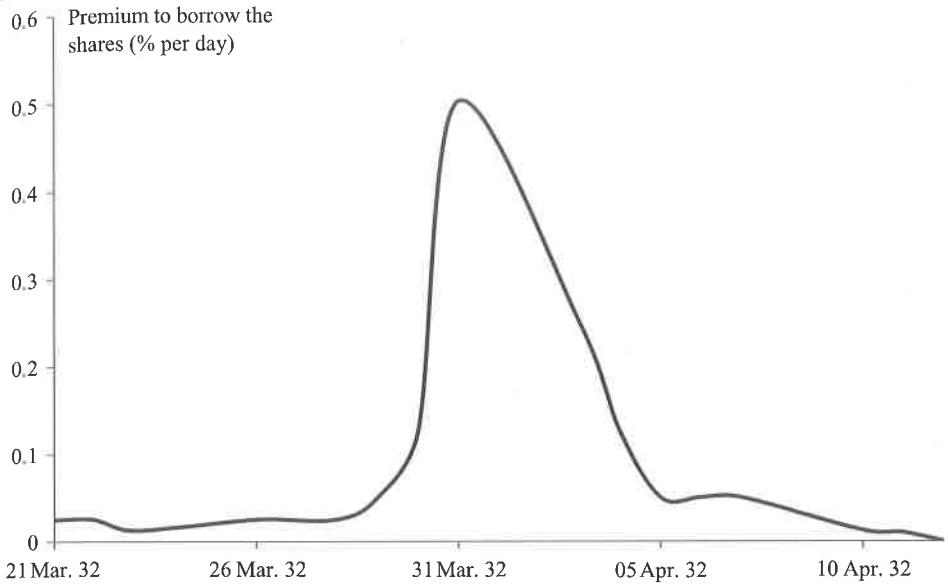


Figure 5.10 Evolution of the daily premium needed to borrow US Steel shares

- Mandates all clearing brokers to close out any fail-to-deliver in "threshold securities" by purchasing securities of like kind and quantity 10 days after the normal settlement date.[7]

The rules include exemptions for market makers engaged in bona fide market-making activities, and for certain transactions between brokers. Prior to this rule, it was common to see some funds giving a vague indication to their broker, and therefore selling a share that neither they nor their broker possessed. It was usually not a problem, because if the fund or the broker bought back the missing stock the next day, the fund would be "flat" by the time it was to be delivered anyway. However, in some cases, the stock was hard to locate and borrow, and this would lead to a fail-to-deliver situation.

Is the situation much better with the SHO rules? Not necessarily. Complaints are regularly heard that some brokers evade the requirements by passing fail-to-deliver positions from one to another. What is more, Regulation SHO has unintentionally created opportunities for short squeezes. The threshold securities list obviously identifies stocks where short sellers (i) are active and (ii) did not find the necessary securities. Certain traders have reportedly made large purchases of stocks listed as threshold securities, driving their price up, and putting pressure on short sellers as their positions lose money and their prime brokers issue margin calls. If the short sellers cannot meet these margin calls, they must close out their positions by purchasing the shares, driving the price still higher.

[7] Rule 203(c)(6) defines "threshold securities" as publicly traded securities where (1) for five consecutive settlement days, aggregate fails-to-deliver at a registered clearing agency are 10 000 shares or more; (2) the volume of fails in a security is equal to at least 0.5% of the reported total shares outstanding in the security; and (3) the security is included on a daily list published by an exchange identifying securities that exceed specified fail-to-deliver levels.

5.3.2 A detailed example

Let us now illustrate the mechanisms of selling short with an example. Take the case of a hedge fund selling short 10 000 shares at $10 each. Its broker applies the 50% initial margin and the 30% maintenance margin requirements.

The current market value of the short sale is $100 000. First, the hedge fund has to check with its broker to ensure that the shares are available for borrowing. Then, it needs to deposit safe securities worth $50 000 into its margin account, and leave the proceeds of the short sale as collateral.[8] The hedge fund account would then appear as follows:

Assets		Liabilities	
Cash	100 000	Short position	100 000
T-bills (collateral)	50 000	Equity	50 000

The short position represents the market value of the short stocks, while equity is defined as the current market value of the assets minus the current market value of the short stocks. The cash comes from the sale of the shorted stocks.

If the stock price climbs from $10 to $11, the (absolute) value of the short position increases. Since the value of the assets does not change, the corresponding loss is absorbed by the equity. The new hedge fund account would then appear as:

Assets		Liabilities	
Cash	100 000	Short position	110 000
T-bills	50 000	Equity	40 000

Now, the new equity amount represents 36.36% (40 000/110 000) of the value of the short position, which is still above the 30% maintenance margin. Note that the equity is computed as a percentage of the short position, because this is what changes when market prices change.

One may wonder which stock price will create the first margin call. With a 30% maintenance margin, we have:

$$\text{assets} - \text{market value of short position} = 0.30 \times \text{market value of short position}$$

That is:

$$\$150\,000 - (10\,000 \times \text{Stock price}) = 0.30 \times 10\,000 \times \text{Stock price}$$

Solving for the stock price and rounding yields $11.54. Assume that the stock price climbs suddenly to $12 per share. The hedge fund account then appears as follows:

Assets		Liabilities	
Cash	100 000	Short position	120 000
T-bills	50 000	Equity	30 000

The equity value now represents 25% (30 000/120 000) of the short position – less than the required 30% maintenance margin. The broker will therefore issue a margin call. The fund manager must respond by depositing an additional amount of $6000 in the fund's margin account. The cash deposit will be added to the cash amount held on the assets side and to the

[8] In the US, Regulation T requires that 150% of the value of the position at the time the short is created be held in a margin account. This 150% is made up of the full value of the short (100%), plus an additional margin requirement of 50% of the value of the position. A less conservative broker could allow the fund to purchase other risky securities later on with the short sale proceeds.

equity on the liabilities side. The new account status will be as follows:

Assets		Liabilities	
Cash	106 000	Short position	120 000
T-bills	50 000	Equity	36 000

The equity now represents exactly 30% (36 000/120 000) of the short stock position. However, any subsequent increase in the stock price will prompt a new margin call from the broker. It would therefore be safer for the fund manager to deposit an amount larger than $6000. Alternatively, the fund manager may also use some of the cash to buy back some shares and return them to the lender, thereby reducing his short position. Note that if a hedge fund ignores the margin call, its broker may use the cash to buy back and close the short stock position, or to bring the equity coverage into an acceptable range. The hedge fund will be held responsible for any losses incurred during this process.

Once again, prime brokers have a key role to play in the short-selling process. Large prime brokers are more likely to have access to hard-to-borrow securities. In addition, they can often offer some sort of cross-margining facilities, i.e. positions held by the hedge fund in various instruments which all require collateralization are grouped and margined together, taking into account offsetting risks and hedges. Such an approach allows for the most efficient use of a hedge fund's capital and optimizes the collateral management process.

5.3.3 Restrictions on short selling

Despite its potential attractiveness, short selling is not widely practised. In fact, it is amazing to observe how our current financial system and its constellation of laws, regulations, institutional norms, variations in practice and fine print are obviously set up to encourage individuals to buy stocks, but not to sell them short.

Since short selling increases the supply of long sale orders in the market, which in turn increases the potential for both disorderly and manipulative trading, the common conjecture seems to be that short sale restrictions can reduce the severity of price declines. Consequently, many regulators have imposed a series of specific short sale constraints that mechanically impede short selling, or at least restrict it to some market participants and/or some liquid securities. These constraints vary from one market to another (see Figure 5.11), but some examples are:

- In Sweden, traders can go short without having borrowed the shares in advance, while individual investors must borrow the shares before they go short.
- In Greece, prior to 2001, short selling was only available to the members of the Athens Derivatives Exchange.
- In Brazil, a short seller must have a domestic legal representative.
- In Hong Kong, until 1996, short sales were only allowed for specific securities designated by Hong Kong Exchanges and Clearing Ltd.
- In Taiwan, foreign and institutional investors are prohibited from shorting, and individuals can only short with special authorization from the Ministry of Finance.
- In Chile, short selling and securities lending are allowed, but they are rarely used because lending is considered an immediate, taxable sale at the highest price of the stock on the day it is lent.
- In Turkey, stock lending is treated as a normal transaction and as such is liable to capital gains tax.

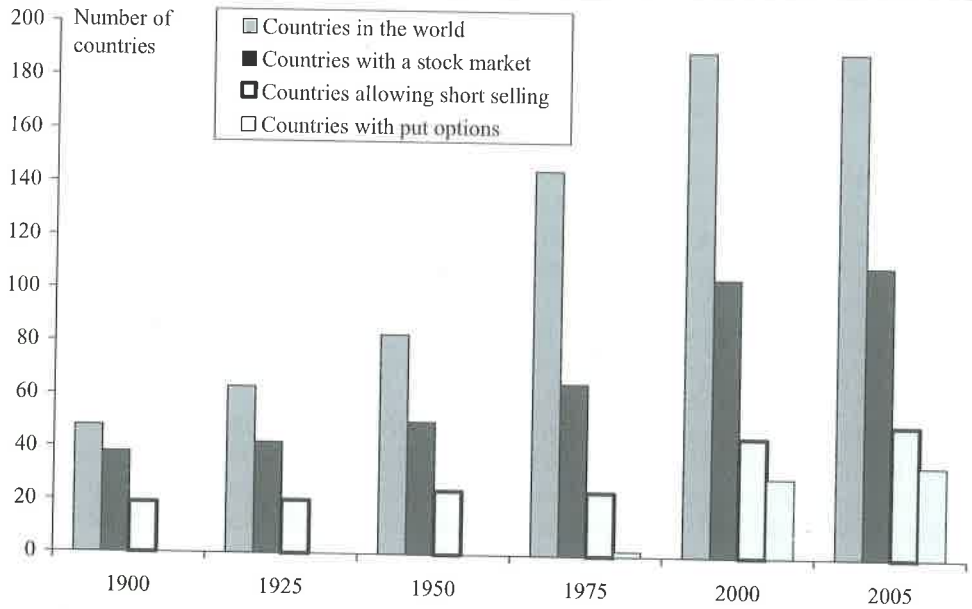


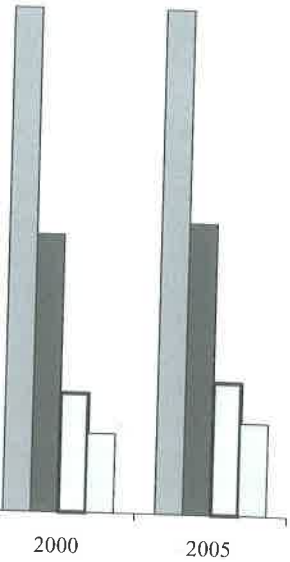
Figure 5.11 Evolution of the number of countries allowing short selling

In addition, several exchanges require short sales to be executed only in a *plus tick* or more commonly in a *zero-plus tick* situation (Table 5.1). A plus tick (also known as an *up-tick*) rule means that the short sale can only take place at a price higher than the last previous transaction in that security. A zero-plus tick rule requires the short sale to take place at a price that can be the same as the immediately preceding transaction but higher than the last transaction in that security at a different price.[9] Both rules are intended to prevent the short selling of a stock that is already declining in price in order to avoid sending stock prices into a free fall. Not surprisingly, no exchange has yet prohibited buying at a price above the last traded price, even though one could argue that it pushes stock prices up.

In some countries, the crusade against short selling has been even more strident. In 1995, for example, the Malaysian Finance Ministry proposed mandatory caning as the punishment for short sellers, and declared that the beating would be "light, similar to the punishment carried out on juveniles" – see Jayasankaran (1995).

These extreme views that regulators seem to have about short selling appear to derive, at least in part, from the relative opacity that surrounds short sales and securities lending. Since securities lending is a private agreement, it is extremely difficult to distinguish a normal sale from a short sale. In addition, a few financial intermediaries (e.g. prime brokers) have information on short positions and stock borrowing figures, while most market participants do not, leaving those with the information in a privileged position. Several jurisdictions and markets have therefore decided to improve the transparency of short selling by publishing

[9] The tick condition that a security is trading in at any given time is indicated on quotation terminals by a "+" or a "−" next to the symbol. On the consolidated ticker tape, a "+" symbol next to the price indicates a plus tick or zero-plus tick from previous trades. Note that, in practice, the strict up-tick rule is hard to apply. Short sellers must never be second in line at a given price, as that would cause the short sale to execute on a zero tick, which is prohibited. Similarly, short sales cannot be easily broken up and executed in multiple pieces, as each transaction sent to the tape would have to take place on an up-tick.



ng

ed only in a *plus tick* or more
lso known as an *up-tick*) rule
the last previous transaction
ake place at a price that can
r than the last transaction in
nt the short selling of a stock
k prices into a free fall. Not
ve the last traded price, even

n more strident. In 1995, for
aning as the punishment for
ar to the punishment carried

rt selling appear to derive,
ales and securities lending.
cult to distinguish a normal
s (e.g. prime brokers) have
e most market participants
n. Several jurisdictions and
short selling by publishing

erminals by a "+" or a "–" next to the
or zero-plus tick from previous trades.
l in line at a given price, as that would
t be easily broken up and executed in

Table 5.1 Summary of short selling practice in various countries

Country	Short selling permitted?	Short selling practised?	Short selling details and restrictions	Tick rule
Albania	No	No		
Argentina	Yes	No	Only allowed for 16 stocks and cannot last more than 360 days in a row. Securities lending is rare and occurs only between brokers	
Australia	Yes	Yes	Liquid securities only, and maximum 10% of the capital issued may be sold short. Not allowed during takeovers. Disclosure is required	Yes
Austria	Yes	Yes		
Belgium	Yes	No	No organized market for securities lending	
Brazil	Yes	Yes	Disclosure on securities lending	
Bulgaria	No	No	Short selling is prohibited	
Canada	Yes	Yes	Disclosure is required	Yes
Chile	Yes	No	Not market practice for tax reasons and cannot last more than 360 days in a row	Yes
China	No	No	Short selling is not permitted	
Colombia	No	No	Securities lending is not permitted	
Czech Republic	Yes	Yes	Possible but the securities must be bought or borrowed in the market before the settlement	
Denmark	Yes	Yes		
Ecuador	Yes	No	Not market practice for tax reasons	
Egypt	No	No	Short selling is not permitted	
Estonia	No	No	Short selling is not permitted	
Finland	Yes	No	The transfer tax laws place a serious burden on the activity	
France	Yes	Yes		
Germany	Yes	Yes		
Greece	Yes	Yes	Short selling has recently been introduced as part of the ADEX securities lending programme	Yes
Hong Kong	Yes	Yes	Liquid securities and underlying securities of a derivative or an approved exchange-traded fund. Extensive disclosure	Yes
Hungary	No	No	Short selling is not recognized market practice	
India	No	No	Not allowed for foreign investors, but local investors (i.e. retail investors and broker/dealers on proprietary books) are permitted to short sell in the market	
Indonesia	Yes	No		
Ireland	Yes	No	Securities lending is limited	
Israel	Yes	No	Short selling in the market is permitted only under certain conditions and circumstances	
Italy	Yes	Yes		
Japan	Yes	Yes	Disclosure is required	Yes
Jordan	No	No		
Lithuania	No	No		
Luxembourg	Yes	Yes		
Malaysia	No	No	Short selling and securities lending were suspended during the Asian crisis of 1997	
Mexico	Yes	Yes	Liquid equities only, with restrictions for foreign investors. Disclosure required	Yes

(*Continued*)

Table 5.1 Summary of short selling practice in various countries (*Continued*)

Country	Short selling permitted?	Short selling practised?	Short selling details and restrictions	Tick rule
Morocco	No	No		
Netherlands	Yes	No	Although permitted, short selling is rarely practised. Disclosure required	
New Zealand	Yes	No	Not market practice for tax reasons	
Norway	Yes	Yes	Reporting required	
Pakistan	No	No	Short selling is not allowed	
Peru	Yes	No	Reporting required	
Philippines	Yes	No	Rules are not clearly defined	
Poland	Yes	No	Although permitted, short selling is rarely practised	
Portugal	No	No		
Russia	Yes	No	Short selling is not a recognized market practice	
Singapore	Yes	No	No restriction, but the exchange may declare a security ineligible for short selling if speculative activity is excessive	
Slovakia	No	No		
South Africa	Yes	Yes		
South Korea	Yes	No	Prohibited to insiders and available only for designated securities. Naked short sales are not permitted	Yes
Spain	Yes	No	Reporting required	
Sri Lanka	No	No	Short selling is prohibited	
Sweden	Yes	Yes	Disclosure required	
Switzerland	Yes	Yes		
Taiwan	No	No		
Thailand	Yes	No	Short selling is allowed only for securities listed in the SET 50 index. Disclosure required	
Turkey	Yes	No	Short selling is allowed only for securities listed in the ISE-100 Index. Disclosure required	
United Kingdom	Yes	Yes		
United States	Yes	Yes	Short selling is permitted	Yes
Venezuela	No	No		
Zimbabwe	No	No		

Source: *International Encyclopaedia of the Stock Market*, *Handbook of World Stock*, Derivative and Commodity Exchanges, and various foreign nationals linked to the finance industry.

aggregated data on short sales. For instance, in April 2003, Hong Kong introduced a disclosure requirement for short economic interests with a view to improving the transparency of the economic interests of substantial shareholders in a company. The major benefit is that investors can then see the extent of aggregate short selling in any particular security and draw their own conclusions from that information. Of course, there must be a limit to the disclosure level as well as to the public transparency, because knowledge of individual market participants' and market makers' open short positions could jeopardize their trading strategies and expose them to increased risk of being caught in a short squeeze. Hence, information is usually aggregated per security and published on an anonymous basis. So far, we are not aware of any exchange

Table 5.2 Example of a few short-selling disclosure regimes

Country	Information required	Frequency	Collector/Publisher
Australia	Aggregate net short position per security	Daily	Exchange
Canada	20 largest short positions	Daily	Exchange
Hong Kong	Short sales per security	Twice daily	Exchange
Japan	Balance of margin transaction per "daily publicized stock"	Daily	Exchange
	Lending balances for "standardized margin transactions"	Daily	Margin lenders
	Balance of margin transaction per issue	Weekly	Exchange + JSDA
	Total balance of margin transactions	Weekly	Exchange + JSDA
	Trading values of short selling	Monthly	Exchange + JSDA
United States	Aggregate short position per security	Monthly	Self Regulated Organizations (e.g. AMEX, NYSE, NASD)

publishing real-time information. The most frequent disclosure is twice daily, in Hong Kong (see Table 5.2 and Figure 5.12 in Box 5.3).

Note that another approach to disclosure adopted in several jurisdictions, including Spain, Sweden and Brazil, is to publish securities lending figures rather than short sales. In some countries these figures may provide a reasonably precise proxy for short-selling activity. In others, they are less useful because stock lending is also used for other activities, e.g. receiving dividends by parties to whom they offer some particular advantage (exercising voting rights, etc).

5.3.4 Potential benefits of short selling

Despite all the arguments advanced by its opponents, short selling brings with it numerous benefits which should not be overlooked. In particular:

- Short selling contributes positively to market efficiency by conveying into the market negative information about securities, facilitating price discovery and reducing the likelihood of overpricing of securities and irrational exuberance. This is borne out by Lamont and Thaler (2003) and Ofek and Richardson (2003), who furnish empirical evidence that the restricted availability of shares for borrowing inhibited short selling and contributed significantly to the recent dot-com bubble.
- Short selling constitutes the first line of defence against financial frauds and even unjustified bubbles. Rumours, false press or internet releases, and unexpected purchases may all cause a run-up in stock prices, which may be followed by a sudden collapse, as the manipulators sell their shares to the unwary. Without short sellers as a counterweight, the magnitude and duration of such fraudulent surges are likely to be much greater.
- Short selling facilitates dealer liquidity provision, particularly where that service guarantees liquidity on a continuous basis. For instance, by going short, a market maker or dealer can meet a customer buy order when he does not hold the relevant securities in inventory, thus facilitating liquidity and continuous trading.
- Short selling facilitates the implementation of several arbitrage strategies, which keep related prices properly aligned (statistical arbitrage, pairs trades, etc.).

Box 5.3 The pulse of the market: short interest

The monthly or daily short interest in a market is not necessarily representative of the intra-day shorting activity. As an illustration, Diether, Lee and Werner (2005) studied the first six months of 2005 and found a tremendous amount of short-term trading strategies involving short sales. According to their study, short sales represent on average 27% of Nasdaq share volume while the monthly short-interest for the same period was only about 3.1% of shares outstanding. Most of the short-term short-sale strategies cannot be explained by the activities of equity and options market makers, which are exempt from short-sale rules. Short selling by exempt traders represented only 7.8% of reported share volume, leaving the remaining 18.9% unexplained.

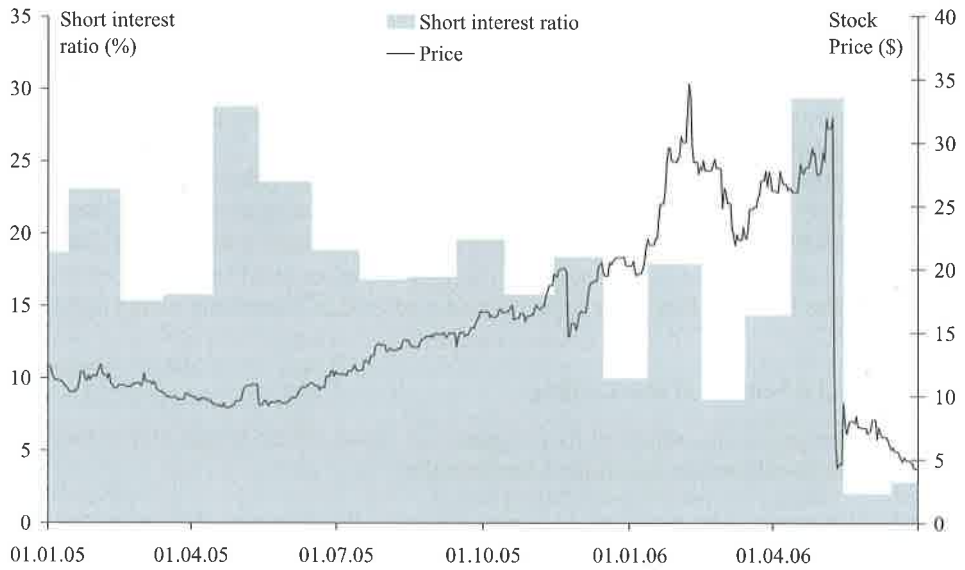


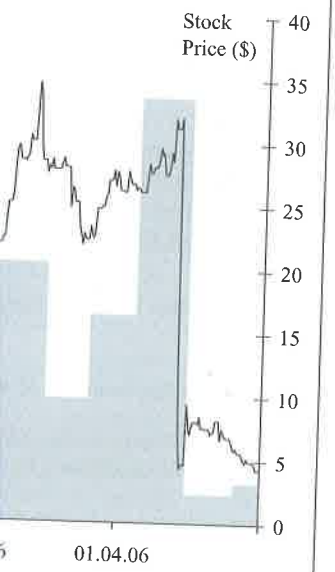
Figure 5.12 Evolution of the short interest ratio for the Escala Group stock. The short interest ratio is the ratio of the number of shares sold short over the average daily trading volume

Unlike investment banks and financial intermediaries, short sellers have no conflict of interests because they have no ties with the companies they are targeting (see Box 5.4). Their research is independent, and sometimes visionary. In 1989, for example, the House Committee on Government Operations (Commerce, Consumer and Monetary Affairs Subcommittee) held hearings about the alleged evils of short selling, featuring testimony from three supposedly victimized firms. Later, the SEC charged the presidents of two of these three firms with fraud, and their stock prices collapsed.

5.3.5 Alternatives to securities lending: repos and buys/sell backs

As we have seen, short selling requires an efficient market of securities lending. In practice, when borrowing securities is difficult, there are several alternative ways of obtaining exactly

cessarily representative of the
and Werner (2005) studied the
of short-term trading strategies
represent on average 27% of
he same period was only about
strategies cannot be explained
ch are exempt from short-sale
3% of reported share volume,



p stock. The short interest ratio
rading volume

sellers have no conflict of in-
argeting (see Box 5.4). Their
ample, the House Committee
y Affairs Subcommittee) held
mony from three supposedly
f these three firms with fraud,

backs

curities lending. In practice,
e ways of obtaining exactly

Box 5.4 When Osama bin Laden sells short

Following the 11 September 2001 attacks in the US, David Ruder, chairman of the SEC from 1987 to 1989, raised the question of whether terrorists may have profited from their attacks by short selling stocks. Indeed, there had been a sharp increase in short selling of the stocks of American (+20%) and United Airlines (+40%) during the month before 11 September. The trading activity far outpaced the rise in short selling for all stocks on the New York Stock Exchange – or other major airline stocks as a group (+11%) on the Big Board, according to a computer analysis released by the New York Stock Exchange. After 11 September, Chicago Board Options Exchange data showed 1575 put options purchased in United Airlines' parent company five days before the attacks, whereas, on an average day, only 390 such put options are purchased. Investors also bought 2258 put options in American Airlines' parent company, compared with 220 on a typical day, and insurance and other stocks also experienced an upswing in short sales.

Federal securities and law enforcement investigators immediately started looking at unusual trading activities in the stocks of AMR Corp. and UAL Corp., the parent companies of American and United, as well as a number of other securities in the days leading up to the terrorist attacks. Their general conclusion was that there were a number of legitimate reasons for the increase in short selling that had nothing to do with terrorism. For instance, the airline industry was in serious financial trouble even prior to the attacks, as business and consumer travel demand slacked off in a weakening economy. Both AMR and UAL had posted huge second-quarter losses in July and said they could be in the red for the rest of the year. Moreover, short selling on the exchange had continued to increase month after month.

It is interesting to note that a similar claim was made in 2005 in the UK following the London transit system attacks, as it appeared that some had profited by short selling the British pound in the 10 days leading up to the attacks. At that time, the pound had fallen by about 6% (approximately 1.82 to 1.72) against the dollar for no apparent reason. The fall did not go unnoticed by investigators, who wondered whether the terrorist masterminds had decided to make some money out of their action or whether other investors with inside information about possible attacks had taken advantage of that knowledge. Despite vigorous efforts to find out who was behind the short selling, hopes are slim that the culprits will be found.

the same economic outcomes, although the legal form and accounting and tax treatment may differ. Let us mention two of them.

Sale and repurchase agreements (repos)

These are a good substitute for direct securities lending, and they form the bulk of bond lending transactions. In a repo transaction, one counterparty (called the "seller") agrees to sell securities to another (called the "buyer") for a fixed amount of cash, and simultaneously undertakes to repurchase the same security at a future date and at a fixed price. In a sense, the seller acts as a security lender – he owns the security, and lends it as collateral to borrow cash. The lending fee is implicitly equal to the difference between the initial selling price and the agreed repurchase price – it is usually translated into an interest rate which is referred to as the repo

rate for that security. The buyer acts as a security borrower – he has invested money at the repo rate, but obtained the security as a collateral.[10] Most of the time, the principal of the loan in a repo transaction is less then the full price of the collateral security in order to further protect against any potential losses due to counterparty default. The difference between the price of the collateral security and the loan amount in a repo is referred to as a haircut.

Repos are frequently used by hedge funds to finance their positions and manage their leverage. On the flip side, reverse repos are often used as short-term investments. Note that while repurchase agreements can be negotiated for any term, the majority of repurchase agreements are for overnight terms and the counterparties often choose to renew the repo by renegotiating the repo rate on a daily basis.

Buys/sell backs

These are similar in economic terms to repos, but are structured as two independent transactions, i.e. an immediate sale and a purchase for a future settlement date. In a buy/sell back transaction, the purchaser of the securities receives absolute title to them. In particular, he retains any accrued interest or dividend/coupon payment during the life of the transaction – although from an economic perspective, the repurchase price takes into account these elements. In practice, buys/sell backs apply almost exclusively to bonds.

5.4 DERIVATIVES

Financial derivatives are another useful weapon in the trading panoply of hedge funds, and yet they too are widely criticized. The term "derivatives" refers to a large number of financial contracts in which a payment or delivery depends on the value of an underlying asset, interest rate or index. A derivatives contract therefore *derives its value* from the value of another asset or quantity, hence its name. In this sense, although most investors do not perceive them as such, simple bonds are derivatives because they derive their price from the level of interest rates – who said that all derivatives were risky and speculative?

Financial derivatives are not new. They have been around for years and are an integral part of a market economy. Market historians found evidence of derivatives in ancient India, Israel, Greece and Rome, as well as in medieval Europe and Japan (see Box 5.5). More recently, in 1865, the Chicago Board of Trade organized a large-scale agricultural futures market. However, the real development of derivatives started when the United States and other industrial nations abandoned the Bretton Woods system of fixed currency exchange rates. This resulted in extreme fluctuations in currencies and interest rates, and was followed by an inflationary oil price shock. Both elements created a strong demand for new hedging instruments that would facilitate the transfer of various risks to institutions which, because of their greater financial reserves and/or financial talent, were better able to manage them.

In 1973, the Chicago Board Options Exchange (CBOE) opened for business and started trading options. This was the first time that an exchange itself had acted as counterparty rather than being just the venue where the contracts were negotiated. But trading options without a model was like wandering in the desert without a compass. Fortunately, the same year, Fischer Black, Myron Scholes and Robert C. Merton provided the first reasonable mathematical model

[10] Some people call the buyers activity a reverse-repo transaction.

has invested money at the repo
e, the principal of the loan in a
urity in order to further protect
difference between the price of
to as a haircut.
ir positions and manage their
rm investments. Note that while
ority of repurchase agreements
enew the repo by renegotiating

s two independent transactions,
. In a buy/sell back transaction,
. In particular, he retains any
ne transaction – although from
nt these elements. In practice,

panoply of hedge funds, and
to a large number of financial
f an underlying asset, interest
rom the value of another asset
tors do not perceive them as
rice from the level of interest

years and are an integral part
atives in ancient India, Israel,
e Box 5.5). More recently, in
ural futures market. However,
s and other industrial nations
rates. This resulted in extreme
n inflationary oil price shock.
ents that would facilitate the
ater financial reserves and/or

ned for business and started
l acted as counterparty rather
ut trading options without a
nately, the same year, Fischer
sonable mathematical model

Box 5.5 The first derivatives users

Possibly the most ancient surviving story of two parties entering into a contingent claim contract can be found in the writings of Aristotle, who recounted that Thales, the Greek philosopher from Miletus, used to forecast in the stars the quality of the next season's harvest. He then made option-like agreements with olive-press owners in Chios and Miletus, in which he undertook to pay them some money upfront in exchange for later exclusive access to their olive presses if needed. When the harvest came, all producers suddenly needed these olive presses and paid Thales high prices to use them. In a sense, Thales bought call options on the olive presses to speculate, while the olive-press owners were selling call options in order to secure their annual income. While this story is almost certainly apocryphal, there is no doubting its antiquity. This in itself would tend to indicate that option-like agreements were common in Ancient Greece.

The second well-known instance of derivatives occurred during the tulip mania that swept the Netherlands in the 17th century. Tulips originated in Turkey and were first introduced in Holland in 1593 by a famous botanist, Carolus Clusius. Rare and beautiful, they rapidly became a status symbol. Wealthy aristocrats and merchants vied with one another to buy them. Several hobbyists created intriguing colours by breeding the plants. And speculators actively traded existing and non-existing bulbs. Buyers had to place orders with money upfront for delivery at a later date, which is nothing less than a forward contract. This in turn led to a trade in "tulip futures", where notarized paper orders were traded at the Amsterdam Bourse and the East India Company at higher and higher prices pending delivery of the bulbs themselves. This forced tulip retailers to buy call options and futures to protect themselves against sudden price rises imposed by their suppliers. Finally, growers also bought put options and sold futures contracts in order to make sure they would receive good prices for their bulbs. Around 1636, the tulip speculation reached its peak. Some single tulip bulbs sold for 4600 florins, roughly the price of 460 sheep. In February 1637, tulips crashed. People who thought of themselves as extremely rich were reduced to poverty overnight.

for the pricing of options. The methodology that they introduced has since been expanded for use in pricing a wide variety of derivative instruments and contingent claims that have changed the face of finance by creating new ways of analysing, managing and transferring risks.

In the 1980s, the growth of derivatives was further facilitated by the shifting geographic pattern of international savings and investment, and the globalization of financial markets. In particular, the transformation of the United States from a net supplier of funds to a major borrower, and the emergence of Germany and Japan as major lenders, encouraged the development of new, low-cost, risk-managing financial instruments that could be traded in international financial markets in order to reduce the costs and risks associated with international borrowing and lending.

Unfortunately, the tremendous growth of the financial derivatives markets and reports of major losses associated with derivative products have also generated a great deal of confusion about those instruments. Derivatives have often been stigmatized by the media as a new pariah, and have acquired an aura previously associated with deficits and drugs. Our goal here is quite modest, namely, to give a brief introduction to the main types of derivatives contracts. We focus

primarily on understanding the way they work rather than on their pricing. Readers interested in knowing more about derivatives and their valuation should refer to Hull (2005).

5.4.1 Terminology

In general, derivatives markets are split into an unregulated *over-the-counter* (OTC) market and a regulated *exchange-traded* sector. Over-the-counter contracts are negotiated between two parties, typically an end-user and an investment bank. Their primary advantage is that they can easily be customized to meet the end-user's specific requirements in terms of size, maturity dates, underlying assets, etc. Unfortunately, this additional flexibility also comes with a series of drawbacks:

- Each OTC contract is drafted with specific terms and conditions, and therefore inherently carries legal risks.[11]
- The selling price may be unfair to the end-user, because it is privately negotiated rather than given by a market where intermediaries compete.
- There is an important counterparty risk, because OTC derivatives are usually not marked-to-market (i.e. there are no margin calls). The consequences of a default may therefore be weighty.
- There is no centralized market and therefore no liquidity. If the end-user wishes to modify or unwind a transaction, he must renegotiate the change with the original dealer, which is not always feasible or efficient.

By contrast, exchange-traded contracts are transacted through a regulated exchange. They are standardized and cannot be specially tailored to specific situations. However, they also have several advantages:

- The exchange or its clearing house acts as the counterparty for each transaction, which ensures sufficient liquidity and reduces default and settlement risks.
- All contracts are marked-to-market on a daily basis by margin requirements and margin calls, so that default risk and its consequences are minimized.
- As a result of the standardized maturities, contract sizes and delivery terms, all contracts are entirely fungible. This means that contracts dependent upon identical terms are totally interchangeable, which allows buyers and sellers to close out a position through a closing transaction in an identical contract.

5.4.2 Basic derivatives contracts

Today, the most common types of derivatives are forwards, futures and options.

- *Forwards* are the original and most basic form of an OTC derivative contract. Simply stated, forwards are agreements to purchase or sell a given quantity of an underlying asset at a fixed price determined at the outset, with delivery or settlement at a specific future date. The settlement can be made by physical delivery or by a net cash payment. Both parties are obliged to perform, and neither party charges a fee. Forwards are not marked-to-market each day, there are no margins required and no interim cash flow occurs.

[11] Legal risk may be reduced by using International Swaps and Derivatives Association (ISDA) master agreements that define the general terms and conditions for trading. The actual trades are documented in confirmation sheets, which are then filed as attachments to the master agreement.

heir pricing. Readers interested
refer to Hull (2005).

over-the-counter (OTC) market
ntracts are negotiated between
r primary advantage is that they
ments in terms of size, maturity
ibility also comes with a series

tions, and therefore inherently

privately negotiated rather than

atives are usually not marked-
of a default may therefore be

the end-user wishes to modify
h the original dealer, which is

h a regulated exchange. They
ituations. However, they also

for each transaction, which
t risks.
gin requirements and margin

delivery terms, all contracts
on identical terms are totally
a position through a closing

es and options.

ative contract. Simply stated,
of an underlying asset at a
ent at a specific future date.
cash payment. Both parties
ds are not marked-to-market
w occurs.

SDA) master agreements that define the
eets, which are then filed as attachments

- *Futures* are contracts similar to forwards, but they are exchange-traded and standardized as to the quantity, the specific underlying assets or commodities and the time. Only the price and the number of contracts are negotiated in the trading process. Futures are marked-to-market on a daily basis, via postings to the parties' margin accounts maintained at a futures broker and at the clearing house.[12] They are most commonly settled through an offsetting "reversing" trade rather than by delivery of the underlying item or cash settlement.
- *Options* are over-the-counter and exchange-traded contracts that give their purchaser the right, but not the obligation, to buy (call option) or sell (put option) a given quantity of an underlying asset at a specified price (strike price). The right may exist over a time span (American option) or only on a specified date (European option). Since an option is a right and not an obligation, the purchaser of an option has to pay the seller (writer) of the option a fee, referred to as the option premium. The premium will vary depending on several parameters, such as the moneyness of the option (that is, where is the strike price with respect to the underlying asset price), the volatility of the underlying asset, the level of interest rates and the time period over which the option can be exercised. Some options, if exercised, may be settled by a cash payment rather than by delivery of the underlying assets or commodities to which the contract relates.

Of course, there are many variations and combinations of the three contracts described above. For instance, *forward rate agreements* (FRA) are OTC agreements to exchange an amount of money based on a reference interest rate and a reference principal amount, referred to as the notional amount, over a specified period of time. FRAs differ from other forwards in that only an amount based on interest rate differentials, and not the principal, are transferred between parties. Consider, for example, a three-month FRA between a hedge fund and a bank with a \$10 million notional principal amount. Then the bank would pay the hedge fund according to the following formula:

$$(\text{Three-month LIBOR rate in three months} - 4\%) \times \$10\,000\,000.$$

If in three months' time, the three-month LIBOR rate is 5%, the bank will pay the fund \$100 000. Alternatively, if the three-month LIBOR rate has fallen by 1%, the fund will pay the bank \$100 000.

- *Caps* and *floors* are over-the-counter interest rate options. An interest rate cap will compensate the purchaser of the cap if interest rates rise above a predetermined rate (called the strike rate) while an interest rate floor will compensate the purchaser if rates fall below a predetermined rate (also called the strike rate).
- *Swaps* are over-the-counter contracts to exchange cash flows as of a series of specified dates. These cash flows are usually based on an agreed-upon notional amount and agreed-upon fixed and floating interest rates. For instance, in an interest rate swap, one party would agree to pay a fixed rate while the other would pay a floating rate. In a currency swap, the payments would involve two different currencies. In practice, swaps can be synthetically recreated by combining several forward or futures contracts.
- *Total return swaps* are contracts that allow investors to receive all of the cash flow benefits of owning an asset without actually holding the physical asset (Figure 5.13). At trade inception,

[12] To reduce default risk, futures exchanges operate a clearing house which acts as a counterparty for all contracts. When an investor takes a position in futures, the clearing house takes the opposite position and agrees to satisfy the terms set forth in the contract. Thanks to the clearing house, the investor need not worry about the financial strength of the party taking the opposite side of the contract.

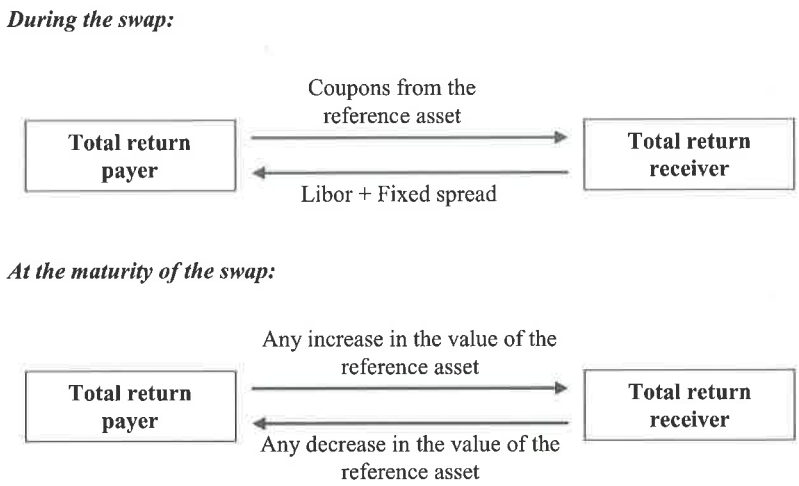


Figure 5.13 Mechanics of a total return swap during the swap (top) and at maturity of the swap (bottom)

one party, the total return receiver, agrees to make payments of LIBOR plus a fixed spread to the other party, the total return payer, in return for the coupons paid by some specified asset. At the end of the term of the total return swap, the total return payer pays the difference between the final market price of the asset and the initial price of the asset.

- *Swaptions* are options to enter into swaps.
- *Contracts for difference* (CFDs) are OTC agreements between two parties to exchange in cash the difference between the opening value and the closing value of a given instrument (e.g. a single stock or an index). In a sense, they are similar to futures contracts although they do not have a fixed expiry date or contract size. CFDs are widely used to replicate positions in single shares without the need for ownership of the underlying shares. They only require a deposit of cash collateral rather than the payment of the full value of the underlying position, they are usually exempt from stamp duty and they can be sold short without having to borrow shares – all you need is to find the counterparty willing to buy the CFD. The contracts are subject to a daily financing charge, usually applied at a previously agreed rate above or below LIBOR or other interest rate benchmark. Users pay to finance long positions and receive funding on short positions in lieu of deferring sale proceeds. The use of CFDs has become widespread in the United Kingdom with some commentators suggesting that up to 25% of UK stock market turnover is attributable to CFDs.

5.4.3 Credit derivatives

Credit derivatives emerged in the mid-1990s as bilateral OTC instruments that enable credit risk[13] to be easily transferred from one party to another without transferring ownership of the underlying asset. They enable the credit profile of a particular asset or group of assets to be split up and redistributed into a more concentrated or diluted form that appeals to the various risk appetites of investors. By using them, banks can offer clients as much credit as they need and

[13] Credit risk encompasses the consequences of all credit-related events ranging from a spread widening through a ratings downgrade all the way to default.

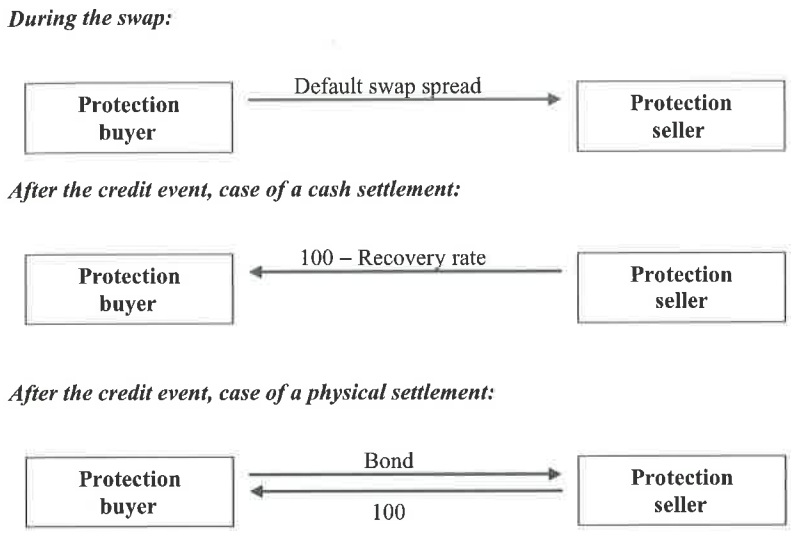


Figure 5.14 Mechanics of a credit default swap

simultaneously mitigate the impact of risk concentrations in their portfolio. Industrial firms may hedge the credit risk implicit in their receivables. Investors can gain synthetic exposure to the credit markets without buying bonds or extending loans. And arbitrageurs can arbitrage among credit derivatives and other markets.

Credit derivative products have evolved over time to suit the various needs of buyers and sellers of credit risk, but the most highly utilized credit derivative remains the *credit default swap* (CDS – see Figure 5.14). The CDS is the simplest, most liquid and most efficient way to hedge concentrations of single-name credit risk. In a sense, it is similar to an insurance contract, providing the buyer with protection against the risk of default or significant credit deterioration of an asset issued by a specified issuer.

A credit default swap is an OTC bilateral agreement between a "protection seller" and a "protection buyer". The protection seller promises to compensate the protection buyer against an economic loss in a "reference asset" if a "credit event" occurs. In return, the protection buyer pays a fee, either upfront (for short-dated contracts, the transaction then being called a credit default option) or on a regular basis (for long-dated swaps). In practice, there are several important features that need to be agreed between the counterparties and clearly defined in the contract documentation before a trade can be executed. These include:

- The credit event itself. Typical credit events are a bankruptcy (the issuer becomes insolvent or is unable to pay its debts), a failure to pay (the issuer fails to make interest or principal payments when due), a debt restructuring (the configuration of debt obligations is changed in such a way that the credit holder is unfavourably affected), an obligation acceleration or an obligation default (the debt obligations of the issuer become due before their originally scheduled maturity date), or a repudiation/moratorium (the issuer of the underlying bond rejects its debt, effectively refusing to pay interest and principal). Note that despite ISDA efforts to clarify credit event definitions, CDS default events are not always obvious to the counterparties.

- The reference asset to be considered, and in particular the capital structure seniority of the debt that is covered. This is extremely important, because the reference asset will be used to determine the amount of money lost after the credit event, and therefore the payoff in a cash settled default swap (see below).
- The settlement mechanism. Default swaps can be cash or physically settled. In a cash settlement, the protection buyer will receive an amount equal to the par value minus the price of the defaulted asset. The price of the defaulted asset is typically determined via a dealer poll conducted within 14–30 days of the credit event, the purpose of the delay being to let the recovery value stabilize. In a physical settlement, the protection buyer will deliver the defaulted security to the protection seller in return for its par value in cash.

CDS contracts can efficiently mitigate risks in bond investing by transferring a given risk from one party to another without transferring the underlying bond or other credit asset. Prior to creation of the CDS, there was no vehicle to transfer the risk of a default or other credit event, such as a downgrade, from one investor to another. CDSs can also be used as a way to gain exposure to credit risk with no requirement of an initial funding, which allows leveraged positions. Moreover, a CDS transaction can be entered into where a cash bond of the reference entity of a particular maturity is not available. Further, by entering a CDS as protection buyer, one can easily create a "short" position in the reference credit. With all these attributes, CDSs can be a great tool for diversifying or hedging one's portfolio.

In the early days of the CDS market, pricing of contracts was more an art than a science. Today, however, pricing is more quantitatively based, using parameters such as (i) the default probability of the underlying, established on the basis of credit data, (ii) the floating leg of the swap, i.e. the expected payoff in case of default and (iii) the fixed leg, i.e. the initial swap spread which is valued on the assumption that the protection buyer stops paying after the default takes place. In theory, CDS spreads should be closely related to bond yield spreads, or excess yields to risk-free government bonds. In practice, as we shall see, there may be some tiny differences, and therefore some arbitrage situations.

An *equity default swap* (EDS – see Figure 5.15) is a hybrid of a credit derivative and an equity derivative. As with a CDS, an EDS is a vehicle for one party to provide another party with some protection against a possible event relating to some reference asset. With a CDS, the reference asset is a debt instrument and the protection is provided against a possible default or other credit event. With an EDS, the reference asset is some company's stock and the protection is provided against a dramatic decline in the price of that stock. For example, the EDS might provide protection against a 70% decline in the stock price from its value when the equity default swap was initiated. The event being protected against is called the trigger event or knock-in event.

The EDS has several advantages over the CDS:

- The trigger event – the drop of the stock price below a given level – is easier to define than a credit default, where some corporate events may or may not constitute default.
- The recovery rate is fixed with the EDS, while it must be determined for the CDS.[14]

The EDS is usually quoted as a spread over LIBOR, in basis points per annum. Because an EDS is more likely to be triggered than a CDS, it generally trades at a higher spread. The buyer

[14] Note that EDS can also be structured with multiple reference stocks. In this case, the credit event occurs when any first stock in the list defaults (first to default swap), or when the number of defaults in the list reaches a certain number (nth to default swap).

capital structure seniority of the
the reference asset will be used
nt, and therefore the payoff in a

or physically settled. In a cash
qual to the par value minus the
et is typically determined via a
, the purpose of the delay being
the protection buyer will deliver
s par value in cash.

ing by transferring a given risk
bond or other credit asset. Prior
risk of a default or other credit
Ss can also be used as a way to
unding, which allows leveraged
ere a cash bond of the reference
ring a CDS as protection buyer,
With all these attributes, CDSs

was more an art than a science.
arameters such as (i) the default
data, (ii) the floating leg of the
d leg, i.e. the initial swap spread
ps paying after the default takes
d yield spreads, or excess yields
e may be some tiny differences,

id of a credit derivative and an
party to provide another party
eference asset. With a CDS, the
led against a possible default or
npany's stock and the protection
k. For example, the EDS might
from its value when the equity
t is called the trigger event or

level – is easier to define than
ot constitute default.
termined for the CDS.[14]

points per annum. Because an
es at a higher spread. The buyer

credit event occurs when any first stock in
certain number (*n*th to default swap).

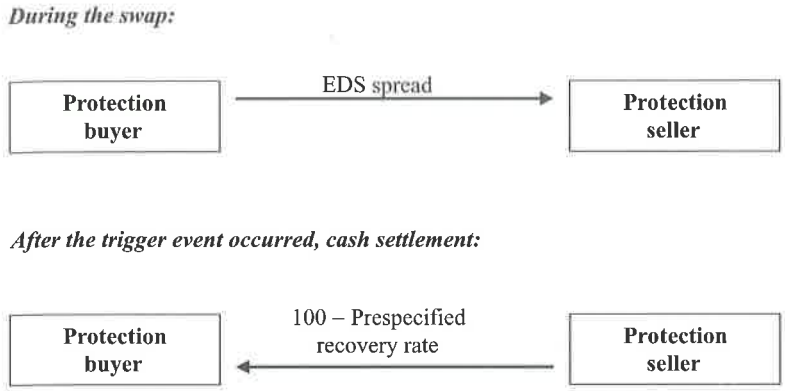


Figure 5.15 Mechanics of an equity default swap

of the equity protection pays the protection seller a quarterly premium based on this spread, which is the fixed leg of the swap. If the underlying default event occurs, then the EDS is cash settled, with the buyer paying accrued spread to the protection seller and receiving a fixed amount (100% minus a prespecified recovery rate) on the notional amount of the EDS.

The EDS valuation is therefore based on (i) the level of the trigger event for equity default, (ii) the probability of the equity default, and (iii) the expected recovery rate, which is fixed at the beginning of the contract (Box 5.6). From a pricing perspective, an EDS is similar to a deep out-of-the-money long-dated American digital put. A key difference is that the option premium is paid in a series of instalments that cease when the option is triggered.

5.4.4 Benefits and uses of derivatives

Derivatives would obviously not have become so popular if they did not offer investors attractive opportunities. Let us mention some of them.

- *Risk management (hedging):* It is essential to understand that, unlike *spot transactions*, all *derivatives transactions* are settled in the future and require some sort of uncertainty to take place. The uncertainty might be related to interest rates, exchange rates, the value or volatility of an asset, etc. Derivatives are powerful financial tools that allow market participants to reduce their exposures to uncertainty. Basically, an existing transaction may be hedged by engaging in a derivatives transaction that offsets the potential losses. To an extent, hedging can be seen as a form of insurance, where the insurance premium is equivalent to the price paid for the derivative as well as the lost profit opportunities (in cases where the market movements are favourable). Note that while the concept of hedging is easy to understand, the application is rarely simple. To hedge correctly, one must (1) identify properly one's risk exposure and (2) determine the hedge ratio, i.e. the size of the position to be taken in derivatives in order to reduce the risk exposure by the desired amount.
- *Speculation:* Speculation with derivatives is basically betting on market movements. Whereas hedgers want to eliminate an exposure to movements in the price of an asset, speculators wish to take a position in the market in order to gain from anticipated, but uncertain, price movements.

Box 5.6 Approximations default probabilities

As a first approximation, the EDS spread can be expressed as follows:

$$\text{EDS spread} = \frac{\text{Implied probability of default event} \times (100\% - \text{Recovery rate})}{\text{Number of years}}$$

This approximation ignores the time value of money and the fact that the payments stop after the default event has taken place, but it is relatively accurate for a short-term EDS. Therefore, the equity default probability priced into the EDS is:

$$\text{Implied probability of equity default event} = \frac{\text{EDS spread} \times \text{Number of years}}{100\% - \text{Recovery rate}}$$

The numerator is the amount paid by the protection buyer until the EDS matures, and the denominator is the amount paid by the protection seller if the equity default event occurs.

As an illustration, consider a five-year 30% EDS on Swiss Reinsurance. Say the EDS with an agreed 50% recovery rate trades at 380 basis points p.a. and the company stock price is at 54 euros. This means that an investor would need to pay €380 000 every year to insure €10 million of the Swiss Reinsurance stock for five years. If during these five years the stock drops to or below €16.2 (30% of the initial stock price), the investor will receive €5 million (50% of the value of the original position). In this case, the implied probability of equity default (i.e. a drop of 70% from the current level) assumed by the market is 38% (= 3.80% × 5/(100% − 50%)).

- *Leverage:* The initial amount needed to initiate a derivatives position varies from nil (over-the-counter products) to the initial margin deposit or the premium (exchange-traded contracts). In all cases, this is only a fraction of the cash outlay needed to take a similar position in the underlying asset. For hedgers, this is critical because it allows the hedge to be constructed with less cash resources than would otherwise have been the case. In many situations the hedging strategy would not have been feasible without the high degree of leverage present in derivatives. In the case of speculators, leverage allows a greater capital appreciation per dollar invested. Unfortunately, it also results in steeper losses in situations where the market moves against the speculator.
- *Financial engineering:* Derivatives can also be used to transform existing assets into an endless variety of new assets with a different series of cash flows. For example, through swaps, participants may transform their income or payment flows so that their earnings better match their financial obligations, or vice versa. Using options, the most risky asset can become a capital guaranteed product. In many cases, without derivatives such transformations would not be possible or would be more costly.
- *Arbitrage:* Derivatives are a great tool to facilitate arbitrage, both between and within markets. The simplest form of arbitrage involves buying derivative contracts in one market and selling them simultaneously in another, in order to take advantage of price differences or interest rate disparities. More complex forms of arbitrage are available for those with expert knowledge of derivative markets, and we review some of them in the second part of this book.

follows:

100% − Recovery rate)

fact that the payments stop
urate for a short-term EDS.
is:

ad × Number of years
% − Recovery rate

til the EDS matures, and the
equity default event occurs.
s Reinsurance. Say the EDS
p.a. and the company stock
pay €380 000 every year to
rs. If during these five years
ce), the investor will receive
case, the implied probability
sumed by the market is 38%

position varies from nil (over-
mium (exchange-traded con-
led to take a similar position in
ws the hedge to be constructed
case. In many situations the
gh degree of leverage present
eater capital appreciation per
n situations where the market

m existing assets into an end-
For example, through swaps,
at their earnings better match
ost risky asset can become a
s such transformations would

oth between and within mar-
e contracts in one market and
ntage of price differences or
vailable for those with expert
m in the second part of this

Finally, another interesting feature of derivatives is that they are not limited by the market size of an underlying commodity or instrument. In particular, most derivatives positions are closed before maturity and never result in physical delivery of the underlying. In some cases (e.g. weather and inflation derivatives), the underlying asset does not even physically exist. Consequently, the size of any given derivatives market depends on the willingness of counterparties to enter into offsetting transactions to exchange financial risks.

5.5 LEVERAGE

Leverage is cited so often and in connection with so many different types of financial arrangements that it is easily misunderstood. Simply stated, the term "leverage" denotes a situation where the amount of money invested or the economic exposure is higher than the available equity capital.

Leverage can be measured in a number of ways. The traditional measure is the balance sheet leverage, i.e., the ratio of the fund's balance sheet assets to equity. Although it is widely used in the hedge fund world as a risk measure, balance sheet leverage has several weaknesses. In particular, it fails to take into account market, credit and liquidity risks in a portfolio, as well as the use of off-balance sheet products such as derivatives. A better measure is therefore the "economic leverage", which captures the degree of risk taken on by the fund in relation to its ability to bear that risk, i.e. the ratio of potential gains and losses to net worth. Not surprisingly, measuring economic leverage precisely is far from straightforward.

It is important to realize that leverage is not a feature restricted to hedge funds. An investor buying a new home and financing it by a mortgage is in fact doing a leveraged investment. His equity capital is represented by his personal contribution (say 20% of the total amount), while the rest is financed by external funds. In this case, we would say that the leverage ratio is 5 to 1, i.e. $5 invested for any $1 of capital. Similarly, an industrial company issuing debt and using the proceeds to build a new plant is also leveraging its balance sheet.

Nevertheless, leveraging as applied to investing is often considered an aggressive strategy comparable to gambling. The reason is that it magnifies both profits and losses. For instance, say a hedge fund invests $1000 of its equity capital in a stock that rises by 10%. The fund earns $100, that is, a 10% return. By contrast, if the fund had borrowed $10 000 and invested it along with its original $1000, it could have earned $1100, that is, a 110% return, before factoring in the borrowing costs. Now, what if the same stock had dropped by 10%? If the fund had invested only $1000, it would have lost $100, that is, 10%, and its shares would be worth $900. But if the fund had borrowed another $10 000 and invested it in the stock, the total investment of $11 000 would have fallen to $9900. Instead of losing $100, the fund would have lost $1100 plus the borrowing costs, that is, more than its initial equity capital. Clearly, although leverage opens the door to increased income and gain if the market moves on expected lines, it also creates certain risks if the market trend is contrary to expectations.

With hedge funds, leverage can take several forms. It may, for instance, involve explicitly borrowing external funds via a loan, or implicitly borrowing through a margin brokerage account. Last but not least, hedge funds can also use financial instruments (such as repurchase agreements, futures and forward contracts and other derivative products) to establish positions by posting margins rather than the full face value of the position. In all cases, when calculating the real exposure, the amount borrowed should be treated as a negative allocation. It actually becomes a liability of the portfolio as opposed to an asset. For instance, when a hedge fund with $100 capital borrows an additional $25 against its portfolio holdings, it has a $25 liability

that must be paid for, but it also has $125 to invest. Of course, the operation only makes sense when the return on investment is higher than the cost of borrowing.

As mentioned already, leveraged investing is often dismissed as gambling. We personally disagree with this assertion. In our opinion, leverage, as long as it stays reasonable, plays a positive role in the financial system. It improves market liquidity, lowers credit costs, and results in a more efficient allocation of resources in the economy. It allows younger people to invest more in equities rather than having to wait until they are older and have sufficient resources to do so. And why, one might ask, is borrowing to buy a new home a perfectly natural thing to do, while funding one's future through an investment loan is apparently another story?

The unpopularity of leverage can be traced back to a few disasters encountered by over-leveraged speculators, most of the time because of pyramidal schemes. Once an investment is financed by leverage, the new asset (e.g. the stock) can be used as collateral for obtaining another loan. The only leverage constraint is therefore the degree to which banks and broker-dealers will finance additional trades and allow leverage on leverage. In a sense, over-collateralization may become an eventual constraint in the same way that a reserve requirement on deposits limits the creation of new money.

The best illustration of over-leveraging is arguably provided by the fund called Long Term Capital Management (LTCM). For several reasons, LTCM's counterparties did not take risks properly into account (see Box 5.7). They granted LTCM huge trading lines in a variety of products, and LTCM took advantage of those lines to achieve its exceptional degree of leverage. When the fund almost went bankrupt in 1998, the whole financial system was at risk, and the Federal Reserve had to step in and organize a rescue.

Box 5.7 Long Term Capital Management (LTCM)

LTCM was indeed a very particular hedge fund. Founded in 1994, it was run by some of the brightest minds world wide. Its 16 partners included John Meriwether, a legendary Wall Street figure who founded the arbitrage group at Salomon Brothers,[15] Nobel Prize winners Myron Scholes and Robert C. Merton, the former Federal Reserve vice-chairman David Mullins, and a group of eggheads who had tamed the business of money management with the most elegant models from academia. This array of talent allowed LTCM to successfully start with a capital of $1.25 billion, the most money ever collected at that time to start a hedge fund. The initial terms were rather tough: $10 million minimum investment, three-year lock-up, 2% management fee and 25% performance fee.

LTCM focused on fixed income arbitrage, i.e. finding inefficiencies in the fixed income markets and taking positions that would become profitable when these perceived inefficiencies were eliminated. In theory, LTCM's positions involved little outright market risk, because a long position in one instrument was always offset by a short position in a similar instrument or its derivative. In a sense, LTCM's success was predicated upon other arbitrageurs finding the same inefficiencies *after* LTCM and exploiting them, which in turn would move the market in the direction of the trades LTCM had placed. Most of the time, these inefficiencies were small in magnitude (a few basis points), so that it was necessary for LTCM to take very large, highly leveraged positions in order to generate worthwhile returns.

[15] Although he had to leave Salomon Brothers after its 1991 Treasury bonds trading scandal.

he operation only makes sense
ving.
ed as gambling. We personally
g as it stays reasonable, plays
uidity, lowers credit costs, and
omy. It allows younger people
y are older and have sufficient
a new home a perfectly natural
an is apparently another story?
disasters encountered by over-
chemes. Once an investment is
collateral for obtaining another
hich banks and broker-dealers
a sense, over-collateralization
serve requirement on deposits

by the fund called Long Term
unterparties did not take risks
e trading lines in a variety of
xceptional degree of leverage.
ial system was at risk, and the

994, it was run by some of
Ieriwether, a legendary Wall
hers,[15] Nobel Prize winners
serve vice-chairman David
of money management with
owed LTCM to successfully
ected at that time to start a
inimum investment, three-

iencies in the fixed income
hen these perceived ineffi-
d little outright market risk,
a short position in a similar
predicated upon other arbi-
oiting them, which in turn
d placed. Most of the time,
s), so that it was necessary
der to generate worthwhile

dal.

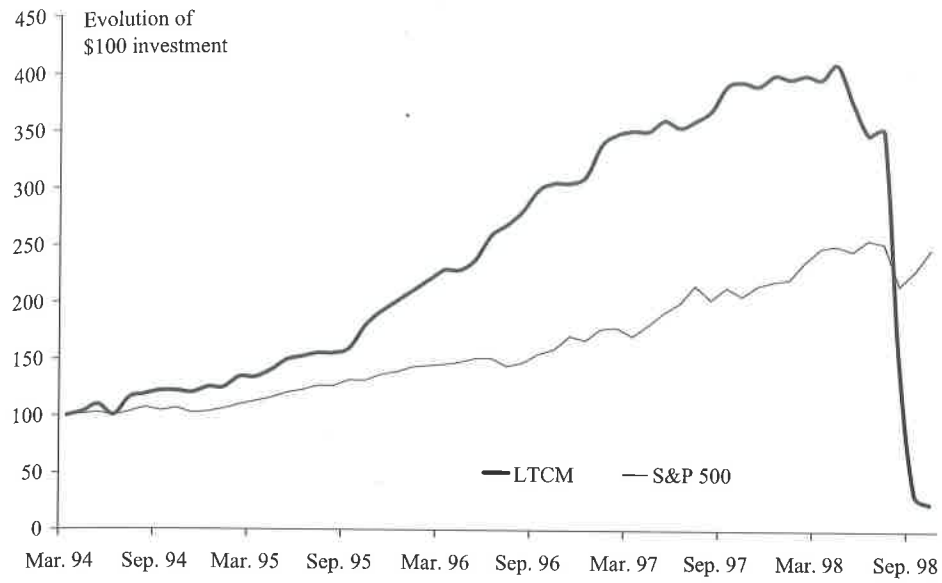


Figure 5.16 Evolution of $1 invested in LTCM and in the S&P 500, 1994–1998

The first years of LTCM were extremely profitable. In 1994-1996, its raw return figures (before fees) were 28%, 59%, and 57% respectively. A dollar invested in LTCM over this time period would have resulted in a net position of approximately $3.50 (Figure 5.16), whereas a dollar invested in the S&P index over that period would have resulted in only $1.60. However, in 1997, the fund showed a dramatic drop-off and only returned 17% versus 31% for the S&P 500. By that stage, the fund's assets had grown to about $120 billion and its capital to about $7.3 billion – a 16 to 1 leverage.

LTCM's partners then analysed the situation and took two decisions. First, they returned $2.7 billion of equity capital to investors, but maintained the size of the fund's positions. This resulted in a significant increase of leverage (25 to 1), and therefore of risk. Second, LTCM branched away from its trademark investment strategies and ventured into new areas where their expertise was less valuable. The new strategies included equity volatility trades (i.e. selling options), equity pairs trading (buying and selling-short equities that were supposed to converge), merger arbitrage, and directional trades on various markets as well as individual stocks.

Most markets were edgy during the first part of 1998, and LTCM did not perform well. Market conditions then started deteriorating in July 1998, when Salomon Smith Barney suddenly decided to liquidate its dollar interest arbitrage positions. LTCM had very similar trades in place and lost 10% over the month. Disaster struck the next month, when the Russian government devalued the rouble and defaulted on its debt.

In early 1998, LTCM had felt that quality liquid investments were overpriced with respect to less liquid or less creditworthy investments. Therefore, it had undertaken many trades in which it was betting that spreads between high-quality and lower-quality investments should narrow. But with the Russian default, the sudden enormous demand for high-quality investments caused these spreads to balloon. Furthermore, the phenomenon was not isolated

to one country or region, but affected all markets, cancelling the expected stabilizing effect of being diversified across many markets. The cost for LTCM was $550 million on 21 August alone. To make matters worse, the fund also sustained major losses on its other speculative positions, particularly its five-year equity short options.

By the end of August, LTCM's capital had shrunk to $2.3 billion and its asset base was approximately $107 billion. This implies a leverage ratio over 45 to 1 – a very high ratio by any standards, but especially in such a volatile environment. On 2 September, LTCM's partners faxed a letter to investors acknowledging the fund's problems and seeking to raise further capital to exploit what (quite reasonably) they described as attractive arbitrage opportunities. Not surprisingly, no new capital or assistance was offered, but the fax was posted on the internet and the fund's problems became common knowledge in the market.

Portfolio losses then accelerated across all trades. On 19 September, LTCM's capital was reduced to only $600 million, with an asset base of approximately $80 billion. All LTCM's counterparties had unanswered margin calls and were observing the fund's sinking fortunes with mounting concern. Almost no one could be persuaded to buy, at any reasonable price, an asset that LTCM was known or believed to hold, because of the concern that the markets were about to be saturated by a fire sale of the fund's positions. LTCM's failure was becoming a "self-fulfilling prophecy," in the words of the social theorist and sociologist of science Robert K. Merton, father of the financial theorist and LTCM partner. At this stage, the Federal Reserve felt obliged to intervene. A delegation from the New York Federal Reserve and the US Treasury visited LTCM on Sunday, 20 September, to assess the situation.

As revealed later by the President's Working Group on Financial Markets (1999), the situation was indeed scary. One dollar invested with LTCM in March 1994 was worth about 10 cents in December 1998. LTCM had initially used its capital as collateral to establish bets on about $125 billion in securities, half in long positions and half in short positions. It then used those securities as collateral to enter into off-balance sheet transactions to a total notional amount of more than a trillion dollars. Among these were futures ($500 billion), swaps ($750 billion) and options, as well as other over-the-counter derivatives ($150 billion). In total, the fund had more than 60 000 trades on its books and a leverage of more than 500 to 1. This situation might not have been considered problematic if LTCM had not faced liquidation. Of course, the leverage before the crisis was "only" about 25 to 1. According to LTCM partners, the fund was targeting a 1% return on assets, leveraged 25 times, which would result in a 25% return. This leverage was less than the 34 to 1 leverage common at securities firms and comparable to the 24 to 1 leverage common at money-centre banks. But one could also argue that money-centre banks have much less volatile assets. So big was its portfolio, so leveraged and so intertwined with so many institutions on Wall Street that liquidating the fund would have disrupted most major markets. The Ferrari had suddenly become an Oldsmobile.

At this stage, a group consisting of Warren Buffett's Berkshire Hathaway, along with Goldman Sachs and American International Group, a giant insurance holding company, offered to buy out the existing shareholders for $250 million and inject $3.75 billion into the fund as new capital. The offer was strictly commercial, i.e. buying the fund for less than its value. It would have saved LTCM from failure, but it would have cost the management of LTCM their remaining equity, their jobs, and any future management fees. Convinced that they could get a better offer from the Fed, LTCM's partners rejected Warren Buffet's offer.

the expected stabilizing effect
CM was $550 million on 21
ined major losses on its other
options.
2.3 billion and its asset base
tio over 45 to 1 – a very high
nvironment. On 2 September,
the fund's problems and seek-
y) they described as attractive
assistance was offered, but the
me common knowledge in the

eptember, LTCM's capital was
nately $80 billion. All LTCM's
ing the fund's sinking fortunes
o buy, at any reasonable price,
of the concern that the markets
LTCM's failure was becoming
rist and sociologist of science
CM partner. At this stage, the
the New York Federal Reserve
er, to assess the situation.
Financial Markets (1999), the
n March 1994 was worth about
apital as collateral to establish
s and half in short positions. It
nce sheet transactions to a total
se were futures ($500 billion),
unter derivatives ($150 billion).
nd a leverage of more than 500
matic if LTCM had not faced
nly" about 25 to 1. According
sets, leveraged 25 times, which
ne 34 to 1 leverage common at
ion at money-centre banks. But
ess volatile assets. So big was
institutions on Wall Street that
kets. The Ferrari had suddenly

erkshire Hathaway, along with
t insurance holding company,
n and inject $3.75 billion into
e. buying the fund for less than
uld have cost the management
management fees. Convinced
tners rejected Warren Buffet's

On 23 September, a consortium of 14 banks led by the Federal Reserve Bank of New York offered to buy 90% of LTCM for $3.65 billion. The funds from this bail-out, combined with the equity remaining in the fund (which had fallen to $350 million in the meantime), brought the total equity value to approximately $4 billion, and the leverage ratio back to a more comfortable 25 to 1. Existing partners would therefore retain a 10% holding, valued at about $400 million, and existing managers would keep their jobs and rights to management fees – a much better offer than Warren Buffet's.

Needless to say, numerous people questioned the necessity of the Federal Reserve intervention and its future consequences. If the Federal Reserve wants to promote market stability, it should ensure that market participants have strong incentives to promote their own financial health rather than just wait for a bail-out from regulators. On 1 October, defending the Fed's decision to assist LTCM, Alan Greenspan explained:

> The act of unwinding LTCM's portfolio in a forced liquidation would not only have a significant distorting impact on market prices but also in the process could produce large losses, or worse, for a number of creditors and counterparties, and for other market participants who were not directly involved with LTCM . . . Had the failure of LTCM triggered the seizing up of markets, substantial damage could have been inflicted on many market participants . . . and could have potentially impaired the economies of many nations, including our own.

Were the Fed's concerns exaggerated? We will never know. Month after month, the consortium that took over LTCM recovered its money, plus a modest profit, and closed shop. To prevent another collapse, several banks scaled down their proprietary trading desks and imposed higher margin requirements when lending to hedge funds. And hedge funds themselves reduced their use of leverage.

What happened to LTCM partners? It seems that they all ended up . . . somewhere else in the hedge fund industry. In December 1999, John Meriwether started a new relative value hedge fund, called JWM Partners. Also based in Greenwich, Connecticut, it manages more than a billion dollars and pursues bond arbitrage strategies similar to those used by LTCM, but with leverage limited to 20 to 1. Most of Meriwether's partners in LTCM joined JWM Partners, with a few notable exceptions. Robert C. Merton returned to Harvard. Myron Scholes started advising Oak Hill Platinum Partners, a hedge fund owned by Texas billionaire Robert Bass and whose founding principal is Chi Fu Huang, a renowned derivatives modeller and fellow alumnus of LTCM. And James McEntee and Gregory Hawkins joined Caxton Corporation to set up a relative value bond hedge fund. It is definitely a small world!

The primary lesson to be learned from the LTCM debacle is that the combination of tremendous leverage and illiquid markets is similar to a vodka party. It often starts well, but ends up badly. Before the Russian collapse, the level of leverage used by LTCM was comparable to the leverage used by banks and securities firms – see Table 5.3. However, two factors distinguish banks and securities firms from hedge funds: (i) they have more diverse sources of income and of funding and (2) they are subject to government oversight that monitors risk management systems, public disclosure and capital requirements. LTCM, by contrast, had very few sources of income and was completely opaque and largely unregulated.

Fortunately, hedge funds have learned from the disaster and most of them have dramatically reduced their leverage. Moreover, their counterparties (banks, brokers, etc.) are now imposing higher margin requirements when lending to hedge funds and put in place stricter rules to control their exposure. It seems that Wall Street can sometimes learn from its losses.

Table 5.3 Leverage ratios of selected securities firms in 1998, based on the president's Working Group hedge fund report as well as the firm's 1998 annual report

Institution	Leverage ratio (assets to equity capital)
LTCM	28 to 1
Goldman Sachs	34 to 1
Leman Brothers	28 to 1
Merrill Lynch	30 to 1
Morgan Stanley Dean Witter	22 to 1

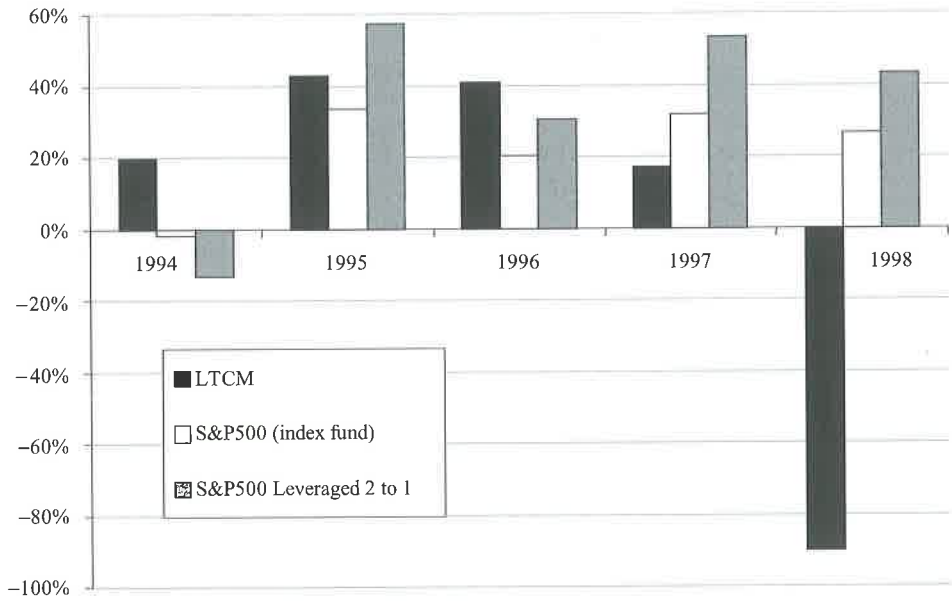


Figure 5.17 Use of leverage: comparing annual returns on three strategies

The second lesson is also related to the use of leverage. Market participants often fail to consider leverage in their comparisons. As an illustration, let us look at the annual return of three investment strategies (Figure 5.17), namely, investing in LTCM, investing in an index fund mimicking the S&P 500, and buying the same index fund on margin using a 2 to 1 leverage. In the last-mentioned case, we assume that interest is paid on debit balances at the rate of 10% p.a.

As can be seen, while LTCM averaged a 29.62% return p.a. between 1994 and 1997, the plain vanilla indexed fund achieved an average return of 20.17% p.a., and the leveraged strategy 28.67% p.a., net of financing costs. If we include the year 1998 (which is obviously unfair), the average return drops to −22.35% p.a. for LTCM, but rises to 21.44% p.a. for the index fund and 31.47% p.a. for the leveraged strategy. Had we taken the risk of leveraging our index fund 50 to 1 as did LTCM, our returns would have been nothing short of spectacular.