Investment management

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Undergraduate study in
Economics, Management,
Finance and the Social Sciences

This is an extract from a subject guide for an undergraduate course offered as part of the University of London International Programmes in Economics, Management, Finance and the Social Sciences. Materials for these programmes are developed by academics at the London School of Economics and Political Science (LSE).

For more information, see: www.londoninternational.ac.uk
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This is one of a series of subject guides published by the University. We regret that due to pressure of work the author is unable to enter into any correspondence relating to, or arising from, the guide. If you have any comments on this subject guide, favourable or unfavourable, please use the form at the back of this guide.
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Chapter 1: Introduction

Finance is essentially about pricing financial assets, but in this subject guide we will focus more on what we use pricing theory for from an investment perspective. We will seek to apply pricing theory (among other things) to tell us something about how to invest our money optimally in financial assets rather than for pricing itself. We will spend some time looking at how to protect our investments using techniques from the area of risk management. For those who want a more thorough overview of pricing theory, see the subject guide for course FN3092 Corporate finance.

Subject guide structure and use

This subject guide is not a course text. Wider reading is essential as you are expected to see the area of study from an holistic point of view, and not just as a set of limited topics. The structure of the subject guide is as follows.

• Chapter 2 introduces you to financial markets and instruments.
• Chapter 3 surveys some of the history behind the innovation of new financial markets and instruments and the return that investors have historically achieved from holding various classes of financial assets.
• Chapter 4 surveys some of the empirical findings regarding active fund management and investment strategies. We look at the performance of mutual funds, the performance of certain popular contrarian and momentum investment strategies, and finally we look at the investment strategies of hedge funds.
• Chapter 5 surveys some of the literature on market microstructure, with the emphasis on how the bid-ask spread is formed in financial markets and on how speculators seek to optimally benefit from their information advantage.
• Chapter 6 discusses optimal investment for investors using optimal diversification strategies.
• Chapter 7 discusses risk immunisation strategies to remove some or all risk factors from the investor’s portfolio.
• Chapter 8 discusses risk and performance measurement.
• Chapter 9 looks at portfolio insurance strategies and value-at-risk based risk management strategies.

Aims and objectives

This subject guide is designed to introduce you to the investment environment in the role of a private or professional investor. This course does not cover pricing theory, which is a major part of FN3092 Corporate finance. Instead, it emphasises the use of pricing theory in investment management. It aims to:

• provide an overview of institutional details linked to financial markets and the trading process
• provide an overview of historical trends and innovations in financial instruments and trading processes
• provide an overview of various financial instruments
• provide insight into the use of finance theory in investment management
• provide a guide to the measurement and analysis of risk of financial investments
• provide a guide to the measurement of performance of fund management
• address key issues in risk management.

**Learning outcomes**

At the end of this course, and having completed the Essential reading and activities, you should be able to:

• list given types of financial instruments and explain how they work in detail
• contrast key characteristics of given financial instruments
• briefly recall important historical trends in the innovation of markets, trading and financial instruments
• name key facts related to the historical return and risk of bond and equity markets
• relate key facts of the managed fund industry
• define market microstructure and evaluate its importance to investors
• explain the fundamental drivers of diversification as an investment strategy for investors
• aptly define immunisation strategies and highlight their main applications in detail.
• discuss measures of portfolio risk-adjusted performance in detail and critically analyse the key challenges in employing them
• competently indentify established risk management techniques used by individual investors and corporations.

**Syllabus**

The syllabus comprises the following topics:

1. Financial markets and instruments: money and bond markets; equity markets; derivative markets; managed funds; margin trading; regulation of markets.
2. History of financial markets: historical and recent financial innovation; historical equity and bond market returns; equity premium puzzle.
3. Fund management and investment: historical mutual fund performance; market efficiency and behavioural finance; return based trading strategies; hedge funds.
4. Market microstructure: types of markets; bid-ask bounce: the Roll model; Glosten-Milgrom model; Kyle model; discrete version of the Kyle model; limit order markets; statistical arbitrage (algorithmic trading, program trading); why market microstructure matters.
5. Diversification: expected portfolio return and variance; definition of risk premium; asset allocation two assets: mean-variance preferences; optimal asset allocation with a risk free asset; CARA utility and normal returns; portfolio frontier; expected return relationships; estimation issues; diversification the single index model; Treynor-Black model; factor models; statistics of asset allocation.
6. Portfolio immunisation: bond math; term structure; duration; numerical examples; immunisation of bond portfolios; convexity and immunisation; immunisation of equity portfolios.

7. Risk and performance management: types of risk; risk decomposition; hedge ratios; Value-at-Risk; Sharpe ratio; Treynor's ratio; more portfolio performance measures; Sharpe vs Treynor; portfolios with changing risk; market timing; non-linear pay-offs; extreme risk.

8. Risk management: risk management for investors; risk management for corporations; risk management for banks; delta hedging; put option protection; put protection vs VaR; portfolio insurance with calls; hedging credit risk; hedging volatility; risk capital allocation.

Reading advice

At the start of each chapter in this subject guide your recommended reading appears in two categories, Essential reading and Further reading, to be found in both textbooks and journal articles.

Essential reading

The course uses two essential textbooks as listed below:


Detailed reading references in this subject guide refer to the editions of the set textbooks listed above. New editions of one or more of these textbooks may have been published by the time you study this course. You can use a more recent edition of any of the books; use the detailed chapter and section headings and the index to identify relevant readings. Also check the VLE regularly for updated guidance on readings.

Further reading

Please note that as long as you read the Essential reading you are then free to read around the subject area in any text, paper or online resource. You will need to support your learning by reading as widely as possible and by thinking about how these principles apply in the real world. To help you read extensively, you have free access to the virtual learning environment (VLE) and University of London Online Library (see below).

Other useful texts for this course include:

Books


Note that this book is very advanced and is not really drawn on except for some initial observations made in the very beginning of Chapter 8 of the guide.


MacKenzie, Donald *An Address in Mayfair*. (London Review of Books) www.lrb.co.uk/v30/n23/mack01.html


**Journals**

There are a number of important journal articles that deal with investment management – those listed here are just a few:


**Online study resources**

In addition to the subject guide and the Essential reading, it is crucial that you take advantage of the study resources that are available online for this course, including the VLE and the Online Library.

You can access the VLE, the Online Library and your University of London email account via the Student Portal at: http://my.londoninternational.ac.uk

You should have received your login details for the Student Portal with your official offer, which was emailed to the address that you gave on your application form. You have probably already logged in to the Student Portal in order to register! As soon as you registered, you will automatically have been granted access to the VLE, Online Library and your fully functional University of London email account.

If you have forgotten these login details, please click on the 'Forgotten your password' link on the login page.

**The VLE**

The VLE, which complements this subject guide, has been designed to enhance your learning experience, providing additional support and a sense of community. It forms an important part of your study experience with the University of London and you should access it regularly.

The VLE provides a range of resources for EMFSS courses:

- **Electronic study materials**: All of the printed materials which you receive from the University of London are available to download, to give you flexibility in how and where you study.
• **Discussion forums**: An open space for you to discuss interests and seek support from your peers, working collaboratively to solve problems and discuss subject material. Some forums are moderated by an LSE academic.

• **Videos**: Recorded academic introductions to many subjects; interviews and debates with academics who have designed the courses and teach similar ones at LSE.

• **Recorded lectures**: For a few subjects, where appropriate, various teaching sessions of the course have been recorded and made available online via the VLE.

• **Audiovisual tutorials and solutions**: For some of the first year and larger later courses such as Introduction to Economics, Statistics, Mathematics and Principles of Banking and Accounting, audio-visual tutorials are available to help you work through key concepts and to show the standard expected in exams.

• **Self-testing activities**: Allowing you to test your own understanding of subject material.

• **Study skills**: Expert advice on getting started with your studies, preparing for examinations and developing your digital literacy skills.

Note: Students registered for Laws courses also receive access to the dedicated Laws VLE.

Some of these resources are available for certain courses only, but we are expanding our provision all the time and you should check the VLE regularly for updates.

**Making use of the Online Library**

The Online Library (http://onlinelibrary.london.ac.uk) contains a huge array of journal articles and other resources to help you read widely and extensively.

To access the majority of resources via the Online Library you will either need to use your University of London Student Portal login details, or you will be required to register and use an Athens login.

The easiest way to locate relevant content and journal articles in the Online Library is to use the **Summon** search engine.

If you are having trouble finding an article listed in a reading list, try removing any punctuation from the title, such as single quotation marks, question marks and colons.

For further advice, please use the online help pages (http://onlinelibrary.london.ac.uk/resources/summon) or contact the Online Library team: onlinelibrary@shl.london.ac.uk

**Examination structure**

**Important**: the information and advice given here are based on the examination structure used at the time this guide was written. Please note that subject guides may be used for several years. Because of this we strongly advise you to always check both the current Programme regulations for relevant information about the examination, and the VLE where you should be advised of any forthcoming changes. You should also carefully check the rubric/instructions on the paper you actually sit and follow those instructions.
The **Investment management** examination paper is **three hours** in duration and you are expected to answer **four** questions, from a choice of eight. You should ensure that you answer four questions, allow yourself an approximately equal amount of time to answer each question and attempt all parts or aspects of a question. Remember to devote some time to planning your answer.

A typical question contains three sub-questions which may not be drawn from the same area, the first of which is relatively less difficult than the other and carries a weight of five marks against 10 marks for the other two.

Remember, it is important to check the VLE for:

- up-to-date information on examination and assessment arrangements for this course
- where available, past examination papers and **Examiners' commentaries** for the course which give advice on how each question might best be answered.
Chapter 2: Financial markets and instruments

Learning outcomes

By the end of this chapter, and having completed the Essential reading and activities, you should be able to:

• accurately distinguish key characteristics between equity and debt claims
• clearly express the main differences between IPOs (initial public offerings) and SPOs (seasoned public offerings)
• contrast exchange traded securities and OTC (over-the-counter) securities in detail
• adequately describe given money market and bond market instruments
• differentiate ‘clean’ and ‘dirty’ bond prices and aptly explain how accrued interest is calculated
• cogently discuss the importance of financial markets regulations.

Essential reading


Further reading


Guide to readings

This chapter is an introductory chapter and contains a great deal of background readings from both the Essential and the Further readings. The Essential reading for the general material in this chapter is contained in Bodie, Kane and Marcus Chapters 1 through to 4. Here you can read the material relatively quickly as there are few technical details to remember. Some of the more technical material in this chapter is covered in Bodie, Kane and Marcus Chapters 14, 20, 22 and 23. Here you can be more selective in your reading, but you may also have to read the material more carefully so that you are sure you understand it properly.

Introduction

Financial assets are distinct from real assets in that they do not generate a productive cash flow – that is what real assets do. Examples of real assets are: a block of flats that can be let to provide the owner with future rental income; the rights to manufacture and sell a particular product generating future sales revenue; or a particular piece of computer software that generates future sales and registration income. Examples of financial assets are: a loan that is used to fund the acquisition of the block of flats and whose payments are financed by the rental income; or equity
capital used to fund the research and development costs for the consumer software products mentioned above. The equity holders benefit in terms of future dividends or capital gains that are generated from the future sales income of the products. From the point of view of cash flow generation, therefore, financial assets do not have much of a role to play. Financial assets are not neutral in the sense that they transform the cash flow of real assets for the holder. For instance, the loan generates a relatively stable income even though the underlying cash flow is risky. Also, the loan might have enabled the investor to raise sufficient funds for investment in the first place. We trade financial assets, therefore, to repackage or transform the cash flow of real assets, either through time or across states of nature.

Financial assets also do another important job – they enable us to separate the functions of ownership and control of real assets. As a rule, real assets do not just passively generate a cash flow – they need to be managed. A company owns a collection of real assets. The job of managing these is highly specialised and it is necessary that it is done by a professional. This individual may or may not be the owner of the real assets, so it makes sense for the company to keep the ownership and control functions separate. This can be done by issuing equity with claims on the real assets of the company – the owners of the company's equity then become the owners of the company – so that the company can hire a professional manager to manage its pool of real assets.

Who uses financial markets? There are three key sectors:

- The household sector – you and me – who need to invest for retirement income or mortgages for house acquisitions and various insurance products, for instance.
- The business sector – consisting of firms that need to issue financial claims on their future cash flow to finance current investments – which need to manage the risk of their business through derivatives trading and insurance products.
- The government sector that has a need to finance public expenditure. This sector is special as it sometimes also intervenes in financial markets to provide a public policy objective – for instance, influence the interest rate to manage inflation – and additionally by acting as a regulator of the activity in financial markets.

On the other hand, financial markets are not the only way these sectors are served by financial instruments. Financial intermediaries also provide services. These are companies such as banks and investment houses which can lend money to, and help companies issue securities, and collect deposits or lend to households, or manage households' and companies' funds. In this chapter, we shall discuss a relatively broad range of financial assets (also known as financial instruments), and their key defining characteristics.

### Money and bond markets

The simplest form of claim is a bond. A bond is a fixed claim – meaning that it promises a particular cash flow – normally a coupon payment that is an annual or semi-annual payment measured as a percentage of the principal amount, and then ultimately at maturity the principal repayment is made. For instance, a 10-year 5% bond with principal 100, will pay a coupon payment of 5% of 100 each year until maturity, or five, and additionally at maturity, in year 10, it pays the principal of 100.
The cash flow promised to bond holders comes from the cash flow generated by real assets. Since the cash flow of real assets is often risky, it may be that there is not enough to pay the promised amount at all times. If this happens, the bond may default. In the example above, for instance, the coupon promises a cash flow of 100 to be paid to the bond holders, but if the corporate cash flow available in year 10, after coupon repayments are made, is only 70 the bond holders stand little chance of receiving their promised repayment of 100. The bond defaults, therefore, and the bond holders can expect to receive at most only 70. Some bonds are, however, practically default-free – for instance, bonds issued by the government (government bonds – they are often called treasury bonds in the USA and gilts in the UK). Bond instruments are traded in the money market or the bond market. The distinction between these markets is essentially that of the original maturity of the instrument. If a bond was issued with very short maturity – normally less than six months – it will be traded in the money market. If a bond has longer maturity it is traded in the bond market. Another distinction is the denomination of the claim.

Normally, money market instruments are traded in large denominations so as to be out of reach of normal households. They are used by banks and corporations to lend and borrow in the short term. Bonds, on the other hand, can be held by households.

Money market instruments

The money market consists of fixed-income instruments of relatively short maturity. This market also tends to be highly liquid, and instruments can be in very high denominations, making it impractical for ordinary people to trade. The players who operated in this market are normally private banks, the central bank and corporations. There are a number of risk free instruments traded, which are issued by the government, such as US treasury bills, certificates of deposits and commercial papers.

Treasury bills (T-bills) initially have a maturity of 28, 91 or 182 days (approximately one, three and six months). Treasury bills have two atypical characteristics that set them apart from many of the other money market instruments. They normally sell in low denominations of US$ 10,000, making them tradeable by individuals.

A certificate of deposit (CD) is a deposit with a bank that has a clearly defined time limit, so cannot be withdrawn on demand. These are, therefore, very similar to T-bills except they are issued by a private bank instead of the government. CDs are in denominations of US$100,000 or greater, and in maturities of three months or shorter. Although there is a theoretical default risk on CDs, they are treated as normal bank deposits, so will be subject to governmental deposit insurance schemes.

A commercial paper is another short term fixed income security that is similar to the ones we have looked at above but is issued by corporations. There is a default risk associated with these instruments, but often they are backed up by a bank line of credit so the borrower can access funds to pay off the commercial paper at maturity. These instruments are also often rolled over at maturity, such that the old commercial paper is paid off by issuing a new one. The denominations are in multiples of US$100,000 so commercial papers are rarely traded by individuals.

An important source of very short term financing used to trade government bonds is the repo market (and the mirror reverse market). A repo (RP) is a repurchase agreement where a dealer sells government
securities overnight to an investor and promises to buy the security back the next day at a given (and slightly higher) price. The transaction is, therefore, equivalent to a one-day loan agreement, since the agreement provides a cash inflow today to the seller (as will be the case with a loan) against a specified cash outflow tomorrow (as will be the case when repaying a loan). These agreements are also very secure to the buyer in the agreement (in this case he plays the role of a lender), who holds the government bond overnight which serves as collateral in case the borrower cannot raise sufficient funds to buy back the bond as promised. A reverse repo is the mirror image, a buy transaction held overnight under the promise of selling the securities the next day. Longer agreements are called term repos, and are used for loans up to 30 days or more.

Another important short term financing market is the market (the London Interbank Offered Rate) which is the rate at which large banks in London are willing to borrow and lend money. Access to this LIBOR market is of course restricted, but the LIBOR rate has become very important as a reference rate, and many short-term fixed income instruments with a floating rate tie their rates to the LIBOR (i.e. the rate is LIBOR plus a margin).

**Bond market instruments**

The bond market also offers fixed income securities, only at longer maturities than the money market instruments. A very large part of this market consists of government bonds – which are debt instruments with payments guaranteed by the government. These bonds are important because they offer investors claims that are in effect risk free, and they are important to the government because they provide an important source of borrowing. Common bonds are Treasury bonds and bills (issued by the US government) and gilts (issued by the UK government). The UK government bond market also trades two very unique types of bonds: consol bonds (bonds with no redemption date, they are in effect a perpetual loan that pays a coupon rate forever); and index linked bonds (bonds where the repayments – coupons and capital repayments – are index linked to the inflation rate). The yield of index linked bonds is the closest we get to a direct estimate of the real interest rate.

Zero-coupon bonds are bonds that have no coupon payments. These bonds always trade below par value (the nominal value of the loan) because of the time value of money. If the interest rate is 5%, the value of a five-year zero coupon bond equals the discounted capital repayment. If the par value is 100, the current price of the bond is 78.35:

\[
\text{Price} = 78.35 = \frac{100}{1.05^5}
\]

The convention in quoting bond prices is to adjust for accrued interest – the clean price. This means that the bond price you actually pay is in general not equal to the bond price that is quoted in the financial pages. The price you pay is the quoted price plus the accrued interest – the dirty price. The adjustment for accrued interest involves stripping the bond price of the first coupon payment. Consider two bonds: one bond has maturity 11 years less one day and the other maturity 10 years plus one day. Both bonds have an annual coupon with rate of 5% prices – the holders of the first bond has just received a coupon payment one day ago, and the holders of the second bond is due a coupon payment shortly in one day’s time. Suppose the discount rate is also 5%. The actual prices of the two bonds are:
Price first bond = \(100.013 = \frac{100 + 5}{1.05^{\frac{364}{365}}}\)

Price second bond = \(104.986 = \frac{100 + 5}{1.05^{\frac{364}{365}}}\)

At the time of the next coupon payment, the bonds trade at exactly par value since the coupon rate equals the discount rate. But because of the difference in the timing of the coupon the actual prices are different. The accrued interest for the two bonds is given by the formula:

\[
\text{Accrued interest} = \text{coupon payment} \times \frac{\text{days separating coupon payments}}{\text{days since last coupon payment}}
\]

We find, therefore, the following quoted prices for the two bonds:

Quoted price first bond = \(100.013 - 5 \times \frac{1}{365} = 100.00\)

Quoted price Second bond = \(104.986 - 5 \times \frac{364}{365} = 100.00\)

The adjustment for accrued interest makes the prices comparable. Bonds are fixed securities but they often feature call provisions. Gilts often have call provisions determining the redemption date so that the UK government may retain flexibility to redeem the bond within given time intervals. It is common in these circumstances to treat the redemption date as the first date in the redemption interval if the coupon rate is greater than the current market rate (so that the loan is relatively expensive compared to the current rate for the UK government) and conversely as the last date in the redemption interval if the coupon rate is less than the current market rate.

**Equity markets**

Equity is, as opposed to a fixed claim like a bond, a residual claim. This means that it has a cash flow that is in the form of the residual cash flow of the real asset after all fixed claims with promised payments are paid off. For instance, if a business is financed by a 10-year bond in addition to its equity, the equity holders have a claim on the business net of the cash flow that is promised to the bond holders. The equity claim is the means by which ownership and control for corporations are separated. When we refer to the owners of a corporation we mean the owners of the corporate equity and not the owners of the corporate debt, although both have claims on the cash flow of the firm. The owners of the equity are, however, normally not directly involved in the running of the corporation – this is the job of the executive manager who is hired to do precisely this job. Therefore, the ownership is separated from the control function in corporations. The manager is hired on a long-term basis (although he may be fired at short notice) whereas the owners of the equity can decide for themselves whether they wish to invest long-term or short-term in the corporation. The separation of ownership and control is, therefore, a simple way to achieve a long-term stable management structure even if the owners of equity are all short-term investors. In partnerships (such as many accounting and legal practices) it would create a great deal of operational upheaval to have ongoing ownership changes taking place.
We can say, however, that the equity holders have more influence on the running of the company than the debt holders. The direct influence of an individual equity holder is nonetheless limited. An equity holder normally gets the right to vote in general meetings. This means in practice that he gets the chance to influence a few very important decisions such as large investment projects or decisions related to corporate mergers and takeover through his vote, and also to influence the choice of who sits on the non-executive board of directors (NED). The NED has a direct oversight on the executive management team of the corporation, and it is essentially through representation on the NED that shareholders have their main influence in the running of the firm. A lot of measures aimed at strengthening corporate governance are aimed at making the NED more effective in overseeing the executive management team.

Initially, companies issue equity that is owned privately (i.e. it is not listed on a stock exchange) by an entrepreneur, a family, or by venture capitalists. The process of making private equity public normally involves the corporation seeking listing of its equity on a stock exchange. The equity can thereafter be traded freely by all investors. The first time a company seeks a listing is called an Initial Public Offering (IPO). Subsequent equity issues are called seasoned issues, and these are much less involved than the IPO since the equity has been traded for a while before the issue. If the company sells existing equity (for instance, if the government sells equity that is already issued but fully state owned) in the IPO or during a seasoned issue, we call it a secondary issue. If new equity is issued, we call it a primary issue. Sometimes the company needs to raise additional capital when it goes public, and in this case it is necessary to make some of the issued equity a primary issue. Otherwise, the issue is primarily a process of transferring equity from the initial owners to the new investors.

**Equity instruments**

Equity instruments consist of stocks – common stocks or preferred stocks – in publicly traded companies. The two most distinctive features are that they are residual claims and that an owner can exercise the right to limited liability (i.e. the owner can decide to relinquish his claim on the real underlying assets and instead hand these over to the other claim holders). A residual claim is a claim that is unspecified, it will be determined as the residual of the total corporate cash flow net of all fixed claims. Therefore, if the corporate cash flow is 100m, on which the debt holders have a fixed claim of 75m, the residual cash flow due to the equity holders is the residual 100m – 75m = 25m. The implication of the fact that equity is a residual claim is that its value can never exceed the value of the total real assets of the firm. The implication of the fact that the equity holders can exercise the right to limited liability is that the value of the equity can never become negative. Common stock and preferred stock differ in two respects. First, common stock holders normally have voting power in general meetings whereas preferred stock holders have not. Second, the claim of preferred stock holders has seniority over that of common stock holders. Thus, if the company wishes to pay dividends to its common stock holders it must first pay a dividend to its preferred stock holders.

Common stock is often split into two classes (dual-class shares), usually called A and B shares. These classes differ in their voting power, where one class (normally A shares) have superior voting power relative to the other class. The reason dual-class share structures are introduced
that a controlling family may wish to retain the majority of the voting power whilst at the same time may diversify by selling B shares to outside investors. Dual-class share structures are relatively rare in the USA and the UK but can frequently be found in Europe and Japan.

**Derivatives markets**

Bonds and equity claims are claims that perform a dual role. For the issuer (businesses, banks or governments), these claims are a means of raising capital used for investment or expenditure. For the investors, these claims are means of smoothing real cash flows across time and states. Derivatives are instruments that do not really play a direct role as a means of raising capital – that is, these instruments are in zero net supply. If no buyer exists for a particular derivative instrument, then also no seller exists. Derivatives are, therefore, almost exclusively used for risk management purposes.

Derivatives are also sometimes called contingent claims. The cash flow of derivatives is almost always linked to the price of a primary asset such as a bond or an equity claim – the underlying asset. In this sense, therefore, the cash flow is a function of, or contingent on, what happens to the price of the underlying asset. However, recently we also observed derivatives that had a cash flow contingent on other events, such as the event that a bond defaults (credit derivatives), or the event that the weather is bad (weather derivatives).

There are three broad types of derivative claims: futures (forwards), options and swaps.

- If you enter into a futures or forward agreement, you effectively undertake the obligation to buy or sell an asset at a specified price in the future.
- An option is like a futures agreement, except that you have the right to buy or sell rather than an obligation. This implies that you have the right to opt out of the transaction if you own an option, but must always carry out the transaction if you own a futures contract.
- A swap is an undertaking to swap one cash flow for another cash flow.

**Managed funds**

Managed funds represent, in essence, a delegation of the investment decision from the individual investor to a professional fund manager. We distinguish between active and passive funds, fixed income and equity funds, and open-end and closed-end funds.

An active fund is one where the fund manager typically makes investment decisions that are in the form of bets – the manager might think that certain sectors or certain stocks are better bets than others and influences the investments of funds to these sectors or stocks. A passive fund is one where the fund manager typically attempts to mimic a broad stock market index (like the FTSE 100 in London and the Standard & Poor 500 in New York). This normally amounts to physically holding the index or a large number of stocks in the index. Open-end funds are funds where the investors clear their holding directly with the fund. Therefore, if a new investor comes in to buy units of the fund the fund simply issues new units. The price the investor pays is the Net Asset Value (NAV) less charges. The NAV is calculated as the total net value of the fund divided by the number of units issued to investors. Closed-end funds are funds which have a fixed number of units issued. If an investor wishes to buy units in
the fund he needs to trade with existing investors. Units in closed-end funds have, therefore, a value which is independent of the value of the assets held by the fund. There have historically been price discrepancies between the total value of outstanding units, and the total net value of assets held by the fund, where units have traded at a considerable discount relative to their theoretical value.

## Exchange traded funds

A fairly new innovation for private investors is the so-called exchange traded funds (ETFs). These are typically index tracker style funds, but they are exchange traded like a stock. This makes it possible for small investors to hold an index cheaply and efficiently without having to physically diversify by trading a large number of stocks in small quantities. Examples of exchange traded funds are the DIAMONDS fund on the NYSE, which delivers the Dow Jones Industrial Average Stock Index, and the iFTSE100 fund on the London Stock Exchange, which delivers the FTSE 100 Index.

## Exchange trading and over-the-counter (OTC) trading

The process by which financial assets are traded can be divided, broadly speaking, into exchange trading and over-the-counter (OTC) trading. Exchange trading involves investors submitting buy-and-sell orders that are aggregated into some system that allows buyers and sellers to be matched directly. OTC trading involves investors submitting buy-and-sell orders to a dealer who acts as an intermediary in the trade. The dealer will normally take proprietary positions in the stock and thereby expose himself to inventory risk, but over time these inventories cancel out as investors execute trades at both the buy and sell side of the dealer’s inventory. Large stock markets such as the NYSE (New York Stock Exchange) and the LSE (London Stock Exchange) are executing exchange trading of securities, whereas the NASDAQ stock market is an OTC market with a panel of dealers offering bid and ask prices for the listed stocks. In a perfect world in which each trader is able to trade at the competitive prices at all times the difference in market structure does not translate into any real differences in the execution of the trade. However, the OTC market structure has been criticised for allowing trading at the bid and ask prices when there exist limit orders inside the spread that could trade at a better price (so-called trading through), and large markets such as the NASDAQ market are working to improve their system. In 1997, the LSE carried out a conversion from OTC trading (much like the NASDAQ market structure) to exchange trading using a fully computerised limit order system (the SETS system). There is no intermediary at all in this market. The NYSE operates a system in which a limit order book executes most trades but that also a significant portion of the trading volume is executed by an intermediary (the so called specialist) who might improve on the quotes implied by waiting limit orders. The benefit of having such an intermediary is that relatively competitive quotes are also offered in stocks that are thinly traded. Chapter 3 of Bodie, Kane and Marcus describes the securities trading process in more detail.
Clearing, settlement, margin trading, short sales and contingent orders

The trading process of stocks has become increasingly sophisticated. All transactions taking place on a stock exchange are cleared once a day, where the net positions are to be settled. If, for instance, you both buy and sell the same security over the course of a single day, it is only the net trading that needs to be settled. Settlement takes place within three working days on the NYSE, so that if you have bought net stock on Monday, you will receive your share certificates and pay the outstanding amount on Thursday. You can also trade stock on margin, which means that you only pay for a part of the purchase price and you borrow the rest from your broker. The broker normally has a working relationship with a bank or a financing house to finance loans made through margin trading. A margin needs to be maintained over time. For instance, if you purchase shares initially worth 10,000 on a 60% percentage margin, you need to pay only 6,000 and you borrow the remaining 4,000 from your broker. Suppose your account stipulates a 50% maintenance margin. If the shares decline in value, suppose they drop to 7,000, your margin would have decreased below 60% also. The margin is now $(7,000 – 4,000)/7,000 = 43\%$, so you need to inject more money into your account to maintain a margin of 50%. After the repayment, your margin is worth 3,500 and the loan is 3,500.

You can sell a stock you do not own to take advantage of price drops. Technically, it is illegal to sell a stock you do not own but you can circumvent these rules by borrowing share certificates from somebody who already owns the stock, which are then short sold. The owner of the share certificates will normally demand a fee. Fund managers who manage large funds (such as pension funds) are often lending their certificates to investors who wish to go short in the stock, since these funds do not normally plan to sell the stock anyway. Short selling is used particularly by hedge funds as an integral part of the investment strategy.

You can also instruct your broker to execute contingent buy-and-sell orders. The most common of these are called limit orders, where you instruct your broker to buy a certain amount of stock as long as the purchasing price is below a certain limit, or to sell a certain amount of stock as long as the selling price is above a certain limit. You can also use so-called stop loss and stop buy orders. A stop loss order is an instruction to sell a quantity of a stock as long as the price remains below a certain limit, and a stop buy order is an instruction to buy a quantity of a stock as long as the price remains above a certain limit. These are used to limit the loss potential of long and short positions. For instance, if you own a large quantity of a stock that has already appreciated in value, you may wish to protect your profit by giving a stop loss order. The sell order comes into effect if the stock price goes below a certain limit. Similarly, if you have a large short position and you wish to protect the existing profit you may be giving a stop buy order.

Working out the profitability of margin trades

When you are trading on margin you are in effect taking a leveraged position, where the total return is shared between the broker (who borrows or lends money from you on his margin account) and yourself. It can become complicated sometimes to work out the return on these trades, so we will go through a couple of examples here of a long trade.
(and we need to work out the return on our initial equity position) and a short trade (which is a loan, and we are interested in the implied loan rate on our net loan, taking into account the deposit on our margin account).

First consider a long position. You buy 1000 shares of a stock at an initial price of 100p per share, and one year later the price is 60p per share. During the year, you receive dividends worth 10p per share. You hold the position for another year, where you receive dividends of 8p per share, and then finally at the end of year two you sell the position at a price of 110p per share. The initial margin is 60%, and the maintenance margin is 40%.

There are three steps to the calculations here. First, you need to work out the gross cash flows. In year 0, the investment cost is £1000 (1000 units times the price of 100p). Then in year one, the cash flow is the dividend payment of £100 (1000 shares times 10p) which we assume arrive at the end of the year (this may not be the case of course but it is the most conservative estimate). Finally, in year two, the cash flow is £1100 from the proceeds of the sale, plus £80 from the dividend payment, a total of £1180. So the gross cash flow is (£1000; +100; +1180). Next, we need to work out the net cash flow. The initial margin is 60%, which means we can borrow 40% on a margin loan. This gives us a cash inflow in year 0 of £400. Following the initial position there is a maintenance margin of 40%, which means we have to keep 60% at the minimum as equity. We do not need to check the end of year two as the margin loan is unwound in any case, so let’s look at year one. Here, the value of the position is £600, and the margin loan is £400, i.e. an equity position of £200, which is 33.3%. We need to maintain a 40% equity, so the maximum margin loan is £360. Therefore, we need to pay off £40 of our margin loan. At the end of year two the loan is repaid, and if we assume zero interest the cash flow is £360. The margin cash flow is, therefore, (+400; –40; –360). Therefore, the net cash flow is (–600; +100; +1180) + (+400; –40; –360) = (–1000; +60; +1820). The final step is to work out the rate of return on our net investment. Here we use the familiar internal rate of return (IRR) formula from FN3092 Corporate finance:

\[-600 + \frac{60}{1 + \text{IRR}} + \frac{820}{(1 + \text{IRR})^2} = 0\]

which yields a rate of return of approximately 22%.

Now consider a short position. You short 1000 shares of a stock at an initial price of 100p, and one year later the price is 160p per share. During the year there is a dividend payment of 10p per share. You hold the position for another year, where there is a second dividend payment of 8p per share, and then finally at the end of year two you buy back the 1000 shares at a price of 60p per share. The initial margin is 60%, and the maintenance margin is 40% (in practice, it is difficult to short on a margin less than 50% but it can be useful to have a margin percentage different from 50% to illustrate which direction the margin requirement pushes).

As above, the first step is to work out the gross cash flows. In year 0, the proceeds from the short sale raises £1000. In year one, you have to make good a dividend payment of £100 (this is now a cash outflow since you are short in the stock). In year one, you buy back the 1000 shares at a cost of £600, and you have to make good another dividend payment of £80. The total gross cash flow is, therefore, (+1000; –100; –680). Now let us look at the margin cash flows. The initial margin is 60%, which means that you have to deposit at least 60% of the short liability on a margin deposit account. This means that you have to put £600 in the margin account with the broker. You have to maintain a 40% maintenance margin throughout, and as above it suffices to check year one only as you are unwinding the
position in year two. In year one the liability is £1600, and 40% of this is £640. Since you have only £600 deposited, you need to put another £40 in the margin account. Ignoring interest rates on the margin account, therefore, the margin cash flows are (–600, –40, +640). The net cash flow is (+1000, –100, –680) + (–600, –40, +640) = (+400, –140; –40). The internal rate of return formula gives us here:

\[
\frac{400}{1 + \text{IRR}} - \frac{40}{(1 + \text{IRR})^2} = 0
\]

which is a loan with an interest rate of approximately –46.4%. You can learn more about margin trading by reading Fabozzi and Markowitz.

**Regulation of financial markets**

Financial markets are heavily regulated – laying down rules to the way trade can be conducted. Because we often speak of the free market it is easy to forget how strict the rules are that govern financial trading. Regulation is both in the form of self-regulation (where the organisers of the market set the rules) and government regulation (where a regulator appointed by the government sets the rules). The reason for regulation is primarily to provide protection to market participants, particularly those who are relatively vulnerable to abuse or fraud by other investors, brokers or exchanges. What are the main objectives of regulation? The first is to stop companies releasing information to investors that is inaccurate or misleading, or released in a way that gives some investors an advantage over others. The second is to make sure unsophisticated investors are not taken advantage of by more professional or sophisticated investors or by advisers or institutions involved in the trading process.

**Summary**

- This chapter has outlined some basic facts on financial claims and markets.
- There was an overview of bond and money markets in which we trade fixed claims, and an overview of equity markets in which we trade equity claims which are residual claims (the exact opposite of fixed claims).
- There was an overview of derivatives markets, managed funds and exchange traded funds.
- The chapter also dealt with margin trading and how margin accounts work.
- Finally, there was a short discussion of regulation of financial markets.

**Activities**

1. Discuss why we need regulation of markets. Try to look for arguments to support your discussion by looking up, for instance, issues related to regulation on the websites of the London and New York stock exchanges: www.londonstockexchange.com or www.nyse.com.
2. If you buy an asset on a 50% margin, how much would you have to pay initially if the price is 126p per share and you buy 1000 shares? How much more do you need to pay if the price went down to 115p per share?

3. Consider a short sales transaction on a 70% initial margin requirement and 60% maintenance margin. You keep the transaction over five months, and you trade 1000 shares of a stock. The initial price is 100p per share. The price at the end of the first, second, third and fourth month is 95p per share, 120p per share, 140p per share and 110p per share, respectively. The price at the end of the fifth month is 98p per share. Calculate the gross monthly profit, and the net monthly profit taking into account the margin deposit. You can assume the margin deposit account is interest free. What is the net monthly profit if the deposit account pays 0.1% monthly interest rate? What is the net monthly profit if the commission on the sale and the repurchase transaction is 0.5% of the transaction amount?

A reminder of your learning outcomes

Having completed this chapter, and the Essential reading and activities, you should be able to:

- accurately distinguish key characteristics between equity and debt claims
- clearly express the main differences between IPOs (initial public offerings) and SPOs (seasoned public offerings)
- contrast exchange traded securities and OTC (over-the-counter) securities in detail
- adequately describe given money market and bond market instruments
- differentiate ‘clean’ and ‘dirty’ bond prices and aptly explain how accrued interest is calculated
- cogently discuss the importance of financial markets regulations.

Sample examination question

1. a. Explain the difference between exchange trading and over-the-counter (OTC) trading of an asset. Explain the typical characteristics of, and the differences between, debt claims, equity claims and derivative securities.

b. Explain the reasons why financial markets are regulated.

c. You short 1000 shares of a stock at a price of 100 on a 70% initial margin. The maintenance margin is 50%. At the end of the first year the price of the stock increases to 140, and at the same time there is a dividend payment of 10. At the end of year two the price has gone down to 80 and you buy back the stock. What is the return on your short transaction?
Chapter 3: The history of financial markets

Learning outcomes

By the end of this chapter, and having completed the Essential readings and activities, you should be able to:

- broadly identify established examples of financial innovations and their fundamental characteristics
- discuss the main benefits financial innovations provide to investors
- confidently explain the notion of ‘equity premium puzzle’ in the context of financial markets
- clearly define risk aversion and the risk aversion coefficient
- aptly characterize constant absolute risk aversion utility functions (CARA).

Essential reading


Further reading


Introduction

In this chapter we look at the historical and empirical evidence surrounding financial markets and assets. The first part surveys the innovations regarding financial instruments and the trading process in financial markets. The second part surveys the history of investment returns on financial assets. Three questions are addressed in particular:

- What return can investors expect to earn when investing in various types of financial assets?
- What are the risk characteristics of these returns?
- Are returns and risk characteristics linked?

An interesting issue is the historic relationship between the risk and return on various instruments. If investors are risk averse we expect to find they demand compensation for holding risky portfolios. This will be discussed in relation to the so-called ‘equity premium puzzle’.

A history of financial innovation

Many early civilisations made use of loan agreements between individuals, and in the old Babylonia and Assyria, several thousand years BC, there were at least two banking firms in existence. Equities and bonds were developed during the sixteenth century. Convertible securities also have a
long history. In continental Europe in the sixteenth century there existed equity issues that could be converted into debt if certain regulations were broken. Similarly, preferred stock has been in use for a long time. Exchange trading of financial securities also has a surprisingly long history. Equity was traded in Antwerp and Amsterdam in the 1600s. Moreover, options and futures (called 'time bargains' at the time) were traded on the Amsterdam Bourse after it was opened in 1611.

Many of the European stock markets experienced major stock market bubbles in the eighteenth century. A famous example is the South Sea Bubble (1720) where the price of the South Sea Company rose from 131% of par in February to 950% by June 23, then fell back to 200% by December. This bubble led to the so called Bubble Act which made it illegal to form a company without a charter or to pursue any line of business other than the one specified in the charter.

We also know of early examples of speculative bubbles.

**Recent financial innovations**

The 1960s witnessed a number of innovations driven by regulatory constraints. The Eurobond market emerged where non-US companies could borrow in US$. At the time foreign borrowers were excluded from the US markets. Similarly, currency swaps were developed during this period to circumvent UK exchange controls. The 1970s witnessed the introduction of floating-rate instruments (bonds with coupons tied to a floating rate such as the LIBOR rate in London), and the trading of financial futures, such as futures on foreign currency, futures on interest rates and futures on stock market indices.

Often, the innovation of new securities is initially driven to circumvent regulatory constraints or to exploit market demand for new types of claims. Once they become established, however, the investors find they have other, broader, advantages that make them a useful addition to the financial system. Below you can find a few case studies of new innovations.

**Case study 1: Floating-rate debt**

Floating-rate notes were first issued in 1970, and it was an instrument that was linked to a floating reference rate – the London Interbank Offered Rate (LIBOR). These instruments came in during a period when inflation risk became a serious threat, so the nominal rate would fluctuate dramatically. Allowing loan rates to vary in accordance with these fluctuations was a natural response. In the mid-1970s the market for floating-rate debt started growing significantly, and these instruments were fairly widely used in the early 1980s. Most floating-rate debt is issued in the European market, and these instruments have never been particularly popular in the USA. A spin-off innovation is floating-rate preferred stock, a preferred stock in which the dividend yield is linked to variations in the reference rate.

**Case study 2: Zero-coupon bonds**

Zero-coupon bonds were first issued in the 1960s, but they did not become popular until the 1980s. The use of these instruments was aided by an anomaly in the US tax system, which allowed for deduction of the discount on bonds relative to their par value. This rule ignored the compounding of interest, and lead to significant tax-savings when the interest rates were high or the security had long maturity. Although the tax-loophole was
closed fairly quickly, the bonds were desirable to investors because they were very simple investment tools. For a bond that has interim coupon payments the investor would have to reinvest these coupon payments – and there may be considerable risk tied to these reinvestment strategies. A zero-coupon bond has no reinvestment risk.

Case study 3: Poison pill securities

The popularity of corporate acquisitions and mergers has promoted the emergence of a number of anti-takeover techniques. Some of these have taken the form of financial innovations. One of the earliest was the so-called preferred stock plans. With these, the target company (the one that the bidding company seeks to acquire) issues a dividend of convertible preferred stock to its shareholders, which grants certain rights if the bidding company buys a large position in the target firm. These rights might be in the form that the stockholders can require the acquiring firm to redeem the preferred stock at the highest price paid for common stock in the past year. If the takeover actually goes through, the highest price will almost certainly be the takeover price, and the acquiring company must, therefore, issue a number of new stock at the takeover price in exchange for the old preferred stock already issued. This will, obviously, dilute the gains of the takeover to the acquiring party and reduce the likelihood of a takeover.

Another poison pill security is the so-called flip-over plan. This consists of the issue of a common stock dividend consisting of a special right. This right enables the holder to purchase common stock at an exercise price well above the current market price. Normally, nobody would exercise these rights as the exercise price is high compared to the current market price. However, in the event of a merger, they ‘flip-over’ and give the right to purchase common stock at an exercise price well below the current market price. Again, this makes takeovers costly as the bidder’s profits from the takeover are heavily diluted by the exercise of the flip-over plans.

Case study 4: Swaps

The first swaps that emerged in the 1960s were currency swaps, and they emerged like many other innovations on the back of regulation. In this case, a UK-based multinational company might have a surplus of funds in the UK that it wished to invest in a US subsidiary but was prevented due to UK exchange controls. A counterparty in the USA with the opposite problem, a surplus of US funds but a need to invest in a UK subsidiary, could often be identified. Since regulation prevented a straight transfer within each company, the companies could circumvent the rules by simply using parallel loans – the US firm promised to lend dollars to the UK subsidiary against the UK firm promising to lend pounds to the US subsidiary. A major problem with these arrangements soon emerged, however, which was that there was a considerable amount of counterparty risk involved. A company might have entered into the agreement fully solvent but might experience problems in the interim period before expiry. If one party defaulted, would the other party still be obliged to fulfil their part of the arrangement? This deficiency could be overcome by the swap agreement, where, in principle, the companies deposited money with each other and paid the interim interest payments to each other according to the prevailing interest rates in the two currencies, and finally the principal amount is cleared at the end of the agreement. The interim payments are normally netted out using the prevailing exchange rate, so there is only one payment made.
The swap agreement has also been modified to agreements involving swapping cash flows of adjustable (floating) rate loans and cash flows of fixed rate loans. In this case, principal payments are not made in the same way as currency swaps – these are also netted out so that the swap agreement effectively consists of a series of single payments.

Case study 5: Futures trading
The standardised financial futures contracts are a relatively recent innovation, in contrast to the older, forward style agreements that have existed since the emergence of a financial system. An important feature of this contract is the way it is traded, which makes it easy for investors to enter and exit existing futures agreements in between the start of the contract and the maturity date of the contract. More importantly, however, is that futures trading allows investors to shift large amounts of risk with very little investment. Futures trades are, therefore, highly levered. For example, margin trading of equity typically involves a margin of 50%, so even if the investor can borrow he still needs to finance half the investment cost (and further margin calls if the stock price goes down). With futures positions, investors normally maintain margins less than 10% of the face value of the futures contract. The futures contract is marked to market each day, so the investor can unwind his position (sell if the original transaction was a buy and vice versa) and his account is settled with no further cash flows taking place.

Case study 6: Credit default swaps
The credit default swap is a derivative security that does not use a financial asset as the underlying security, but rather the credit event associated with a bond or money market instrument. The buyer of the credit default swap undertakes to pay a given amount to the seller until a credit event occurs. The credit event could be a default of the underlying bond instrument, but it could also be a ratings downgrade. If a credit event occurs, the seller must pay the buyer an amount according to the credit default swap agreement. What is special about these instruments is that they provide insurance against default. If you are an institution lending money to a company, for instance, you can safeguard your investment (since you are lending money the loan is an asset) by simultaneously buying a credit default swap on the same bond or loan. If the company is unable to repay you the money they owe, therefore, you can claim money from the seller (or writer) of the credit default swap.

Case study 7: Collateralised debt/loan obligations
Traditionally, an institution providing a loan to a company would hold the asset to maturity. This is of course a good idea, since it forces the institution that makes the decision to lend to stick to it till the end. If the institution is bad at assessing the risk of the loan it is likely to suffer the loss as well. However, it can also be a bad idea, as it can be constraining for financial institutions that historical lending decisions dictate what they are currently doing. For instance, a financial institution which is good at marketing loans to companies in a particular industry should continue using their expertise in future lending decisions. However, if the industry is facing a downturn with increasing default rates it may be that losses on loans that are made earlier will prevent future lending. In this case, lending to the industry is likely to be serviced by other institutions with less expertise. The idea of selling off loans or bonds is, therefore, a natural one to consider. Collateralised debt or loan obligations is a way of doing just that. The institutions typically packages loans or bonds into
large portfolios, then sell off the loans portfolio bit by bit. The way this is done is by issuing tranches of securities written against the cash flow of the loans or tranches bond portfolio. The senior tranches (typically top rated instruments) have priority claim to this cash flow. The mezzanine tranches (with intermediate rating) have seniority after the senior tranches are serviced, and finally the equity tranche carries the residual claim. It is commonplace that the financial institution selling off loans or debt portfolios in this way retains the equity tranche.

It should be mentioned here that collateralised loan or debt obligations have been cited as one of the factors causing the so-called credit crunch which started in late 2007 and has continued to the time of writing. A problem with collateralised loan or debt obligations is that if the financial institution knows it will be able to sell the loan in the secondary market to outside parties, there is little incentive to make sure its lending decisions are sound. The liquidity in the market for collateralised loan or debt obligations did dry up considerably in late 2007.

Investment returns in equity and bond markets

What returns have investors historically made in the bond and equity markets around the world? We have about a hundred years of data on stock market returns, and the brief answer globally is that the countries most devastated by the Second World War had the lowest long-run cumulative returns – Italy, Belgium, Germany and Japan. The countries that experienced the least damage, in contrast, have the highest long run cumulative returns: Australia, Canada and the USA. However, the real returns (corrected for inflation) are pretty much similar across all countries.

A major theoretical prediction from pricing models is that the expected or average return on assets is linked to the risk of holding these assets. Again, the overall empirical evidence supports this prediction. Looking, for instance, to the US experience from 1926 to 2002, we find the following:

<table>
<thead>
<tr>
<th>Asset type</th>
<th>Geometric average return</th>
<th>Arithmetic average return</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small-company stocks</td>
<td>11.64%</td>
<td>17.74%</td>
</tr>
<tr>
<td>Large-company stocks</td>
<td>10.01%</td>
<td>12.04%</td>
</tr>
<tr>
<td>Long-term treasure bonds</td>
<td>5.38%</td>
<td>5.68%</td>
</tr>
<tr>
<td>US T-bills</td>
<td>3.78%</td>
<td>3.82%</td>
</tr>
<tr>
<td>Inflation</td>
<td>3.05%</td>
<td>3.14%</td>
</tr>
</tbody>
</table>

Table 2.1

For a review of geometric and arithmetic averages, see Appendix 1. If we compare the numbers in Table 2.1 against the variance of returns, we find the following:

<table>
<thead>
<tr>
<th>Asset type</th>
<th>Arithmetic average return</th>
<th>Standard average return</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small-company stocks</td>
<td>17.74%</td>
<td>39.30%</td>
</tr>
<tr>
<td>Large-company stocks</td>
<td>12.04%</td>
<td>20.55%</td>
</tr>
<tr>
<td>Long-term treasure bonds</td>
<td>5.68%</td>
<td>8.24%</td>
</tr>
<tr>
<td>US T-bills</td>
<td>3.82%</td>
<td>3.18%</td>
</tr>
<tr>
<td>Inflation</td>
<td>3.14%</td>
<td>4.37%</td>
</tr>
</tbody>
</table>

Table 2.2
Among asset classes, therefore, there is a clear relationship between risk and return (inflation is not an asset). The more risk the investor takes on, the greater is the compensation in terms of expected or average return. This can be explained by risk aversion - that investors are unwilling to take (actuarially) fair risk.

### The equity premium puzzle

The return on equity is greater than the return on bonds because the risk is smaller. What has been found, however, is that the difference (the so-called equity premium) appears to be bigger than should be expected. The following example from US stock and bond markets is compelling. A person who invested $1000 in Treasury bills on 31 December 1925 and kept it in safe US Treasury bills until 31 December 1995 would have an investment in 1995 worth $12,720. If the money were invested in the stock market the corresponding number is $842,000 (66 times the amount for T-bills). Considering that the equity investment would have survived two large stock market crashes (in 1929 and in 1987), the difference is strikingly large.

How should we compare a risky investment with a risk-free one? One way to do this is by assuming a risk averse investor holds both risk-free T-bills and risky equities in his portfolio (for a review of utility theory and risk aversion, see Appendix 1). The premium on the equity is then compensation for his risk aversion. The greater the premium, the greater the risk aversion of the investor must be. Using historical data, we can therefore make inferences about the risk aversion of investors. Risk aversion is measured by the risk aversion coefficient, formally derived from the utility function by the relationship:

$$\text{Risk aversion coefficient} = -\frac{u''(x)}{u'(x)}$$

If the investor has CARA (constant absolute risk aversion) utility the utility function takes the form $u(x) = \exp(-\rho x)$. The risk aversion coefficient is in this case (as the CARA name suggests), the constant $\rho$.

If asset returns are, moreover, normally distributed, we can write the expected utility function as:

$$\text{Expected utility} = E(x) - \frac{\rho}{2} \text{Var}(x)$$

Suppose a CARA investor is indifferent between holding large-company stocks and long-term US Treasury bills over a long period of time. Then the following expression must hold:

$$0.1204 - \frac{\rho}{2} 0.2055^2 = 0.0382 - \frac{\rho}{2} 0.0318^2$$

which is solved for a risk aversion coefficient of 4. This is a fairly reasonable number, but asset returns are not normal so we cannot use this simple model to estimate the implied risk aversion coefficient. This is the motivation for Mehra and Prescott’s study. They fit a rigorous theoretical model to data on the return on stock market investments and government bonds. The model generates the risk aversion coefficient of a representative investor (see Appendix 1 for a review of risk aversion and the risk aversion coefficient). They found that a reasonable estimate for the risk aversion coefficient is between 30 and 40. This is way too high, as a risk aversion coefficient of 30 implies, for instance, that if the investor is facing a gamble where he has a 50% chance of doubling his wealth and a
50% chance of halving his wealth, he would be willing to pay up to 49% of his current wealth to avoid the gamble, i.e. if his current wealth is 100, he would be indifferent between paying 49 and keeping 51 for sure, and a gamble where there is a half chance of receiving 50 and a half chance of receiving 200. In practice, it would be difficult to find anybody not preferring the gamble in this case.

Can the equity premium puzzle be resolved? Mehra and Prescott might have sampled data that were special in two senses. First, it might have been too short so there is a possibility that the period was in some sense too special to make safe inferences about the implied risk aversion coefficient. Their work has been extended to include data all the way back to 1802. The main finding of this exercise is that the real returns of short-term fixed income have fallen dramatically over time. The real excess return on equity would, therefore, on average be about one percentage point lower than that reported by Mehra and Prescott. This will of course reduce the magnitude of the risk aversion coefficient but it is doubtful that the puzzle would be completely resolved.

The second way the data might have been special is that the time series are too long. This might lead to survivorship bias in the data. When collecting masses of data we inevitably sample those data-series that have survived for a long time. The long-surviving data series would also tend to be healthier and show average returns that are higher than the perceived expected returns at historical points in time. Investors might reasonably worry about the risk of a crisis or catastrophe that can wipe out the entire market overnight. And indeed, of the 36 stock exchanges that operated at the early 1900s, more than one-half experienced significant interruptions or were abolished outright up to the current time. Hence, the equity premium might include some bias if estimated by long time series of data. Again, survivorship bias might be a source of some errors in the estimation of the risk aversion coefficient but it is unclear how much it contributes.

Summary

- This chapter surveyed the historical perspective on the financial system and, in particular, financial innovations of various types. There was a survey of examples of major financial innovations such as swaps and collateralised debt obligations.
- The second part of the chapter dealt with the long term return on various classes of assets, where a strong relationship between risk and return was uncovered.
- This part also covered some controversial issues related to the difference between equity returns and government bond returns – issues related to the so-called equity premium puzzle.

Activities

1. Explain the role of poison pill securities and discuss whether this is a helpful innovation of financial securities.
2. The historical evidence points to the fact that riskier securities have a greater average return. Explain why. We also know that the expected prize in lotteries is smaller than the cost of participating (an example is UK's Lotto: A $1 lottery ticket has an expected prize payment of around $0.45). Can you think of a reason why people are reluctant to accept risk in financial markets but happy to pay for risk in lotteries?
A reminder of your learning outcomes

Having completed this chapter, and the Essential reading and activities, you should be able to:

- broadly identify established examples of financial innovations and their fundamental characteristics
- discuss the main benefits financial innovations provide to investors
- confidently explain the notion of ‘equity premium puzzle’ in the context of financial markets
- clearly define risk aversion and the risk aversion coefficient
- aptly characterise constant absolute risk aversion utility functions (CARA).

Sample examination question

1. a. What is a zero-coupon bond? What makes a zero-coupon bond often a more attractive investment vehicle for investors than a coupon bond?
   b. Explain, in words, the equity premium puzzle. Can bias in the data explain this puzzle? Explain.
   c. Give four examples of recent financial innovations. Explain how they work, and what reasons there are for investors making use of the innovations.
Chapter 4: Fund management and investment

Learning outcomes
By the end of this chapter, and having completed the Essential reading and activities, you should be able to:

• describe fundamental trends in historical mutual fund performance
• confidently explain the efficient market hypothesis and fully distinguish between its many forms
• cogently discuss the existence of common cognitive biases in human information processes, and concisely explain how these biases can lead to effects (momentum and reversals) that violate the efficient market hypothesis
• describe how the effects of momentum and reversals can be translated into profitable investment strategies in detail
• clearly identify distinctive characteristics of ‘hedge funds’ in the context of the investment management industry
• briefly discuss the problems related to evaluating hedge fund performance
• adequately define ‘algorithmic trading’ or ‘statistical arbitrage’.

Essential reading

Further reading
MacKenzie, Donald An Address in Mayfair. (London Review of Books) www.lrb.co.uk/v30/n23/mack01.html

Introduction
Investors do not always invest directly in financial assets. Sometimes they use portfolio or fund managers to invest on their behalf. Professional investors or fund managers now control the bulk of private investment in financial assets, and its sheer size has made this sector a subject of a lot of research. This chapter will provide an overview of the empirical evidence of fund management and investment strategies. In particular, we will discuss whether there is an empirical foundation for the notion that fund managers provide value for money, and whether various types of investment strategies (e.g. technical trading strategies, or the so-called contrarian or momentum strategies) yield abnormal returns.

Among all the evidence surrounding investment strategies to gain long term sustainable trading profits, we find a long list of anecdotal stories
of individuals making huge trading profits in inventive, ad hoc, ways. They are of course interesting in their own right, but it should be noted that they deal normally with trading opportunities that can be exploited only once. The Economist 2004 Christmas Special surveys some cases of exceptionally profitable single trades. An interesting observation is that the cases fall into one of two categories – a normal trader spotting an unexpected arbitrage opportunity, or a large trader using a window of opportunity to exploit his market power. An example of the former is the case of the Italian national Ludovico Filotti who worked for Barings Bank in London. While on holiday in Italy in 1993 Mr Filotti discovered a new savings scheme, guaranteed by the Italian government and issued by Italy’s Post Office offering a very high return relative to the Italian government bonds. Although aimed at ordinary investors, the Post Office had not barred institutions from investing in such bonds. Having borrowed by selling Italian government bonds, Mr Filotti flew personally to Italy with a bankers’ draft of $50m to invest in the Post Office bonds. The trade made a huge profit and is a classic example of an arbitrage transaction – where a trader buys an asset cheaply in one market and sell it expensively in another. An example of a large trader exploiting market power is the case of George Soros who in 1992 betted against the UK Pound Sterling staying in the European Exchange Rate Mechanism (ERM). He borrowed heavily in pounds to invest in other currencies, forcing the Bank of England to use its reserves to buy pounds to prop up the exchange rate. Eventually, the pressure on the Bank of England reserves became so huge the government decided to withdraw the pound from the ERM, netting Soros a profit of around $1bn after unwinding his position.

These cases are atypical and one view is that they are also likely to become less frequent as the financial system becomes more integrated and global, and as the capital markets become more efficient. This view is supported by the evidence of active portfolio management.

**Historical mutual fund performance**

There is a long-standing academic literature that has analysed the performance of fund managers. We discuss the measurement problems associated with this task later on in this subject guide, but note here that it is in general very hard to obtain accurate assessments of fund managers, despite the fact that the outcome of their decisions (the return on the portfolio) is normally very easy to obtain. The difficulties are linked to two factors. First, it is difficult to lay out exactly what the benchmark for normal or expected performance should be. We know that in financial markets, expected returns depend on the risk of the asset. A good way to boost the average return is, therefore, simply to take more risk. This is of course not necessarily a good decision. Second, there is an awful lot of noise in financial markets that makes investment returns very uncertain regardless of whether the investment decision was a good one. A good decision may, therefore, easily end up losing money over a given time period, and a bad decision might easily yield a profit. To sift the good investment decisions from the bad ones in such an environment is, therefore, very difficult. Nonetheless, the broad picture from the USA is the following. Measuring mutual fund performance against a broad stock market index shows that more often than not the broad stock market index outperforms the median fund manager. In addition, of course, investors investing in a mutual fund will pay management fees which they are not liable for when holding the index. Since 1971 the compound return on a broad stock market index has been 12.2% versus 11.11% for
the average fund. Over such a long period, and excluding management fees, this difference is very large.

Although the average fund might not provide much value for money for the investor, it may be that the best funds can. Several studies have examined whether funds which perform better than the average over a two-year period are also likely to perform better than the average in the subsequent two-year period.

<table>
<thead>
<tr>
<th>Study</th>
<th>Initial period</th>
<th>Top half successive period</th>
<th>Bottom half successive period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goetzmann/</td>
<td>Top half</td>
<td>62.0%</td>
<td>38.0%</td>
</tr>
<tr>
<td>Ibbotson</td>
<td>Bottom half</td>
<td>36.6%</td>
<td>63.4%</td>
</tr>
<tr>
<td>Malkiel 1970s</td>
<td>Top half</td>
<td>65.1%</td>
<td>34.9%</td>
</tr>
<tr>
<td></td>
<td>Bottom half</td>
<td>35.5%</td>
<td>64.5%</td>
</tr>
<tr>
<td>Malkiel 1980s</td>
<td>Top half</td>
<td>51.7%</td>
<td>48.3%</td>
</tr>
<tr>
<td></td>
<td>Bottom half</td>
<td>47.5%</td>
<td>52.5%</td>
</tr>
</tbody>
</table>

**Table 4.1**

These results demonstrate that whereas winners and losers among fund managers have a tendency to remain within their group over time, the effect seems to be vanishing over time. The study based on the 1980s data set shows that past winners are almost equally likely to become future winners as future losers. Similarly, past losers are almost equally likely to be future winners as future losers. Fund management performance appears, therefore, to have become more and more associated with luck than with skill.

**Market efficiency and behavioural finance**

The results need to be evaluated against our view of the market. So far, we have implicitly been thinking about the market as a rational price setting mechanism (somewhat similar to the market maker in the Glosten-Milgrom model outlined in Chapter 5). This view of the market is formalised in the efficient market hypothesis, which stipulates that the prices are so-called ‘random walks’ relative to the current information set embedded in the prices. The random walk hypothesis is very easy to understand – if the market thinks the price should go up in the future, it will adjust immediately to reflect this information. The future price becomes, therefore, equally likely to go up as to go down from the current level. There is no predictability about the price movements any more. It is also easy to see where the efficient market hypothesis should come from. If there were predictability in price movements, investors would immediately compete against each other to buy assets that they predict will go up in price and sell assets they predict will go down. Consequently, competition drives prices towards the efficient price levels.

This notion has been formalised into the so-called ‘efficient market hypothesis’, which states that prices follow a so-called ‘discounted martingale process’: 

\[ p_t = E \left( \frac{p_{t+1} + d_{t+1}}{1 + r} \right) \mid I_t \]

where \( E \) denotes the expectations operator, \( p_{t+1} + d_{t+1} \) is the sum of next period’s price and dividends, respectively, and \( r \) is the discount rate. The set \( I_t \) contains the current information. An implication of the efficient market hypothesis is that future price innovations are unpredictable, i.e.
future prices are the forecasted price (today's price inflated by the discount rate) plus an unpredictable pricing error.

The efficient market hypothesis comes in three different versions, the weak-form, the semi strong-form, and the strong-form, depending on how much information goes into \( I \):

- The weak-form efficient market hypothesis states that stock prices reflect all information in past and current prices and transaction volumes. Future price movements are, therefore, unpredictable on the basis of information about these. This rules out, among other things, making consistent trading profits on the basis of so called 'technical analysis'. We know that technical trading is very popular among practitioners, but of course the efficient market hypothesis does not predict that profits cannot be made at all, only that you make roughly the same number of profitable trades as you make losing trades.

- The semi strong-form efficient market hypothesis states that stock prices reflect all publicly available information, which includes, in addition to past and current prices and volumes, company and industry data such as accounting and market data as well as broad economic indicators such as interest rates, currency rates, inflation, and unemployment. Semi strong efficiency rules out making consistent trading profits on the basis of so called 'fundamental analysis'.

- Finally, the strong-form efficient market hypothesis states that all information, public and private, is reflected in the current prices. There are both practical and theoretical reasons why we should not expect markets to be strong-form efficient. On the practical side, there are many restrictions on insider trading making it difficult for those who have private information to benefit from speculation. Thus, there are barriers in place preventing private information to reach the market. On the theoretical side, if we assume prices are strong-form efficient, there is no incentive to spend resources acquiring private information. There is reason to believe, therefore, that prices can never reach strong-form efficiency (this is the so called Grossman-Stiglitz paradox).

What are the implications of the efficient market hypothesis on fund management performance? Only if professional fund managers have better information (or a finer information set) than is currently embedded in the prices, should they reasonably expect to make trading profits. A trader in possession of superior information who trades against an uninformed market expects to make superior trading profits. Of course, there will be some information leakage due to the fact that trading activity is detectable by the uninformed market participants but this process is not perfect so some private information remains hidden, and this is the basis for the superior trading profits. An assessment of the performance of mutual funds within this framework is, therefore, essentially an assessment of whether the fund manager is in possession of a sufficient amount of hidden private information to make substantial trading profits. The private information needs to come from somewhere, however, and fund managers spend enormous resources on acquiring such information (through research, fundamental and technical analysis) each year. It is, therefore, perhaps unreasonable to expect that fund managers should easily be able to make trading profits over and above the holding profits of a broad index.

The efficient market hypothesis is itself subject to criticism, however. Empirical evidence demonstrates certain patterns of predictability in
asset prices, the most prominent being momentum (prices that have
gone up tend to increase further and prices that have gone down tend to
decrease further) and overreaction to news and events. For instance, a
study found that portfolios of the best-performing stocks in the recent past
(three- or 12-month holding period) tend to outperform other stocks. The
performance of individual stocks remains highly unpredictable. The fads
hypothesis asserts that the stock market overreacts to news, leading to
positive autocorrelation over shorter time horizons while the stock market
and a reversal or negative autocorrelation over longer time horizons.
Although there is empirical evidence to support short run momentum
effects, the long run reversal effect has less conclusive empirical support.
Studies have found, nonetheless, that when ranking stocks into groups
based on their five-year past performance, the loser portfolio (the bottom
35 stocks) outperformed the winner portfolio (the top 35 stocks) by
an average of 25% over the subsequent three-year period. Where do
these patterns come from? The growing field of behavioral finance has
built a systematic foundation for the momentum and reversal effects
based on imperfections in the human ability to process new information
rationally. There is substantial evidence to suggest that we tend to add
too much weight to recent evidence, that we tend to be overconfident (a
famous study of drivers in Sweden found that 90% of those asked ranked
themselves better-than-average), that we are also sometimes too slow to
react to news, and finally that our choices are affected by a phenomenon
called framing. An individual might reject a bet when it is posed in terms
of the risk surrounding the potential gains, but may accept the same bet
when it is similarly posed in terms of the potential losses. In this case,
his decision is affected by framing – i.e. the framework within which the
prospect is outlined.
You can learn more about efficient markets and behavioural finance by
reading Chapters 11 and 12 of Bodie, Kane and Marcus.

**Return based trading strategies**

There is now a rapidly growing literature to assess the profitability of
contrarian and momentum trading strategies. Jagadeesh and Titman
find in a study that stock prices react with a delay to common factors,
but overreact to firm-specific information. In Chapter 8 we discuss
factor models of stock returns, and the decomposition of the variance of
stock returns into systematic factor-driven risk and idiosyncratic firm-
specific risk. This study incorporates, therefore, both the overreaction
element in the stock market’s response to firm-specific news, as well as
the conservatism in incorporating new information about factor risk.
This study finds that most of the short-term profits that can be made by
following contrarian trading strategies are due to the tendency of stock
prices to overreact to firm-specific news. The contrarian strategy tested
was based on buying and selling stocks over one month, based on the
previous month’s return. Losers were bought and winners were sold.
In another study, Conrad and Kaul analyse a wide spectrum of trading
strategies that are based on past return patterns, and they find that a
momentum strategy is usually profitable at the three- to 12-month holding
horizon, whereas a contrarian strategy would generate substantial profits
over long horizons prior to 1947 but not after. The return based trading
strategies can be represented by the following weighting of individual
stocks. Consider investing over the holding period \([t - 1, t]\) based on the
return over the time interval \([t - 2, t - 1]\). Portfolios are constructed at
time $t - 1$ on the basis of a weighting scheme using an equally weighted market index. The weights are constructed on the basis of the following formula:

$$w_{i,t-1} = \pm \frac{1}{N} \left( R_{i,t-1} - R_{m,t-1} \right)$$

where $w_{i,t-1}$ is the dollar amount to be invested in stock $i$, $N$ is the total number of stocks considered, $R_{i,t-1}$ is the return of stock $i$ over the time interval $[t-2, t-1]$, and $R_{m,t-1}$ is the corresponding return of the equally weighted index. The sign is chosen to reflect the strategy used (plus for momentum strategies and minus for contrarian strategies). By construction, the investment cost of the portfolio following this weighting scheme is zero:

$$w_{i,t-1} = R_{i,t-1} - R_{m,t-1} = R_{m,t-1} - R_{m,t-1} = 0$$

Since the weights are proportional to the deviation of the asset’s performance relative to the equally weighted market index, they capture the idea that the more extreme deviations lead also to more extreme reversal and momentum effects.

In a study of momentum strategies, Chan, Jegadeesh and Lakonishok find that underreaction to information might lead to momentum trading profits. In particular, they find that past returns and past earnings surprises can each predict large drifts in future returns after controlling for the other. The drifts cannot be explained by market risk, size effects or book-to-market effects. Interestingly, they also find little evidence of a future reversal of the returns process. They conclude, therefore, that the market reacts slowly to new information about the earnings flow.

**Hedge funds**

Hedge funds have become increasingly popular investment vehicles, despite the high profile collapse of the Long Term Capital Management hedge fund (LTCM) in 1998. Hedge funds have no specific definition, but their activity is characterised by very flexible investment strategies involving both long and short positions, often in complex securities. Moreover, investors are often asked to commit their capital for a fixed term such that the hedge fund managers can pursue their investment strategy without the need to worry about investor redemptions. The essential difference between hedge funds and other financial institutions is that they are not heavily regulated.

One of the first hedge funds was set up in 1949: A.W. Jones & Co. developed an investment strategy based on long/short positions in equities. The idea is to buy stocks you think will do well and sell (or short) stocks you think would do badly. If the market moves in the meantime, the long and short positions will move together to maintain your net portfolio value, and you make money if your stock picking is correct (in bull as well as bear markets). As the sophistication of hedge funds grew, so did they turn to other markets. One of the investment strategies in fixed income (bond) markets is the ‘on-the-run/off-the-run’ strategy employed by LTCM. The ‘on-the-run/off-the-run’ strategy employed by LTCM is based on the institutional feature of the US government bond market which issues new bonds every six months. Every new auction brings, say, a new 30-year government bond to the market which investors compete to buy (the bond goes ‘on-the-run’). When the bond is six months old, it becomes a 29.5-year bond and a new 30-year bond is issued. The old bond goes
Chapter 4: Fund management and investment

‘off-the-run’. LTCM observed that the difference between a 30-year bond and a 29.5-year bond is almost imperceptible, so they should have the same yield. In practice, however, there was a spread that was caused by the fact that when the new bond went ‘on-the-run’ its price was bid up. Therefore, LTCM sold short the new 30-year bond and bought the old 29.5-year bond to unwind its position six months later when the spread was expected to tighten (the short position would now be in a 29.5-year bond that is off-the-run’ and the long position in a 29-year bond, also ‘off-the-run’). We have also seen hedge funds going from status as active traders but passive owners in stocks to also become active as owners. An active owner is a shareholder who takes an interest in the running of the company and seeks to influence the management and important decisions. Traditionally fund managers have stayed away from this type of activity. An example is the recent Deutsche Brse’s attempt at a takeover of the London Stock Exchange. A bid, tabled in early 2005, was later withdrawn under pressure from one of Deutsche’s shareholders, a large London-based hedge fund. The fund had allegedly taken long positions in Deutsche and short positions in the London Stock Exchange, since they figured that the announcement of a withdrawal of Deutsche’s bid would cause the London Stock Exchange’s stock price to fall and the Deutsche’s stock price to increase. Their long-short position in Deutsche and London Stock Exchange would, therefore, generate considerable short term trading gains. Do all hedge funds ‘hedge’?

The investment strategy involving market neutral long-short positions (similar to LTCM’s ‘on-the-run/off-the-run’ strategy above) is relatively safe and profitable. As long as the spread between the cheap asset held long and the expensive asset held short tends to narrow over time, the position makes money regardless of other market movements. This is a position, moreover, with little net investment of wealth (there are normally margin requirements so it is impossible to have a zero net investment) and little exposure to outside risk factors. Research into hedge fund returns shows, however, that the idea that hedge funds on the whole engage in long-short market neutral arbitrage trading is misleading. Hedge funds are a surprisingly heterogeneous group of funds adopting a number of different styles. They are, in fact, difficult to define in terms of their trading strategies. What seems often to be the idea behind hedge fund strategies is, however, that they carefully manage and target their speculative activity, choosing to hedge some risk and take a targeted bets on other risk.

Hedge funds may take similar positions, where they cause large market movements and may put the market under a squeeze. These types of trades are called ‘consensus trades’ or ‘crowded trades’. An example of large price movements caused by such a squeeze is the recent stock price movements in the German car maker Volkswagen. In early 2008 Volkswagen’s preference shares were worth half the value of ordinary stock. Whereas ordinary stock has voting power, preference shares have priority to dividend payments, so it seemed preference stock was cheap relative to ordinary stock. A large number of hedge funds bought preferred stock and sold ordinary stock. At the same time the car maker Porsche, which already owned 42.5% of Volkswagen, had been buying call options on Volkswagen stock which, if exercised, would take their ownership to 74.1%. A further 20.2% of Volkswagen ordinary stock is owned by the government of Lower Saxony, which effectively made the ‘free float’ in the stock market for Volkswagen ordinary stock only 5.7% of the total. The hedge funds had collectively sold short (presumably not knowing the extent of their collective action and Porsche’s call option position) 12.9%. When the hedge funds were going to unwind their short position they would need to buy shares that were not available on the free float, i.e. they had to buy from Porsche, which already
had a large long position in the stock and could, in effect, put a ‘squeeze’ on the hedge funds. The resulting panic among hedge funds resulted in a massive increase in Volkswagen ordinary stock share price (which at some point was trading at a price/earnings multiple of over 90 and became, briefly, the biggest company in the world measured by market capitalisation).

Performance of hedge funds

How well do hedge funds do? A problem is that it is very difficult to figure out exactly what a hedge fund is doing, and without knowledge of the fund’s portfolio decisions it can be difficult to assess correctly the fund’s performance. An example is the following, taken from Lo’s book about hedge funds. The following table summarises Lo’s example.

<table>
<thead>
<tr>
<th></th>
<th>S&amp;P 500</th>
<th>Hedge Fund</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monthly mean return</td>
<td>1.4%</td>
<td>3.6%</td>
</tr>
<tr>
<td>Monthly standard deviation</td>
<td>3.6%</td>
<td>5.8%</td>
</tr>
<tr>
<td>Minimum monthly return</td>
<td>–8.9%</td>
<td>–18.3%</td>
</tr>
<tr>
<td>Maximum monthly return</td>
<td>14.0%</td>
<td>27.0%</td>
</tr>
<tr>
<td>Annual Sharpe ratio</td>
<td>1.39</td>
<td>2.15</td>
</tr>
</tbody>
</table>

Table 4.2

This table shows a fund that apparently outperforms the index considerably. The average return is greater for the fund, and although the standard deviation (and therefore also the risk) is greater, the risk reward ratio given by the Sharpe ratio (which you will learn about in Chapter 8 of this guide) is superior for the hedge fund. What is interesting, however, with this example is that it is constructed on the basis of real asset prices and it assumes no privileged information on the part of the hedge fund manager. In fact, the trading strategy is very simple. Each month, the fund shorts put options on the S&P 500 index. The put options are chosen such that the strike price is approximately 7% below the current level, and the maturity is less than three months. The capital of the fund is used as collateral to cover the potential loss on put options. In most months, the puts expire still out of the money, so the hedge funds will simply collect the price of the puts without incurring any extra liability. Therefore, for most of the months the trading strategy provides a stable cash inflow. Some months there are large index movements, and the hedge fund will lose money on puts that are exercised. The problem here is that the trading strategy involves a risk that is asymmetrical: small but frequent gains are measured against large but infrequent losses. Therefore, a statistical analysis of the fund’s performance will underestimate the risk of the fund.

Algorithmic or program trading (statistical arbitrage)

Statistical arbitrage aims at exploiting patterns in price movements to make trading profits, normally using computers to identify buy and sell signals (hence the synonymous algorithmic or program trading label). It is easiest to explain statistical arbitrage by way of the so-called ‘pairs trading’ rule that was developed in the 1980s. The idea is simple: try looking for two stocks (or portfolios of stocks) that behave similarly in terms of prices. When the two diverge, place a bet on convergence by buying the cheaper stock and shorting the expensive stock. For example, suppose two stocks, A
and B, normally have similar prices, but currently A is trading at 80 and B is trading at 110. Buy $x_A$ units of A at a cost of $80x_A$ financed by shorting $x_B$ units of B giving proceeds of $110x_B$. Say $x_B = 80$, then:

$$x_A = \frac{110}{80}, \quad x_B = \frac{110}{80} = 110$$

The net cost of this strategy is zero, and suppose we hold the position until the two stocks have the same price. If they converge when the price of both A and B is 120, the profit is:

$$120x_A - 120x_B = 120(110) - 120(80) = 120(110 - 80) = 120(30) = 3600$$

If they instead converge when the price of both A and B is 50, the profit is:

$$50x_A - 50x_B = 50(110) - 50(80) = 50(110 - 80) = 50(30) = 1500$$

Regardless, if the prices converge we make a trading profit.

We shall now go through a trading strategy which takes advantage of deviations of spreads (or differences) between two rates or assets. The idea is that if today's spread is lower than the average spread you should bet that it will widen tomorrow, and if the spread is higher you should bet that it will narrow tomorrow. Under certain assumptions, this strategy yields a profit 75% of the time, i.e.

$$\Pr(S_t > S_{t-1} \text{ and } S_{t-1} < \mathbb{E}(S_{t-1})) + \Pr(S_t < S_{t-1} \text{ and } S_{t-1} > \mathbb{E}(S_{t-1})) = 75\%$$

To see this, consider the following diagram:

![Diagram](image)

From the figure we can see where profits are not made. We do not make profit if yesterday's spread is above the mean, and today's spread is also above yesterday's spread, and we do not make profits if yesterday's spread is below the mean, and today's spread is also below the mean. This area is highlighted in the next diagram:
Let us assume that the spread each day is an independent draw from the same distributions. It follows that each of the four areas of the diagram to the left or to the right of \( E(S_{t-1}) \) and above or below \( E(S_t) \) (the four rectangular shapes separated by the mean spread) has probability 25%, and the loss-making areas exactly cuts two of these areas in half. Therefore, the probability of making a loss is only 25% and the probability of making a gain is the complementary probability 75%.

You should be careful with an illustration such as this, however, as the assumption that the spread is drawn each day from the same distribution is in fact not innocent. If the spread is unusually large one day, it is likely to be large for a reason, and it is likely that this reason also causes the spread the next day to be high (in expectation). Therefore, the conditional expected spread \( E(S_t | S_{t-1}) \) is likely not to be equal to the long term average \( E(S_t) \) (which, to those of you who are familiar with the laws of statistics, is given by the double or iterated expectation \( E(S_t) = E(E(S_t | S_{t-1})) \)). The observation of a high spread should not, therefore, necessarily mean that we expect the spread to narrow the following day. In fact, what happened around the collapse in LTCM (as was also the case with Volkswagen shares) was that spreads that were seen as unjustifiably large did not narrow over time but kept widening further. There just is no simple way of making money in financial markets.

**Summary**

- This chapter took an investor perspective on the history of finance, and looked at the historical evidence of the performance of the managed fund industry.
- The main finding was that managed funds do not, on average, outperform broad stock market indices, which is indicative that markets tend to be informationally efficient.
- The chapter went on to discuss critics of the efficient market hypothesis who use arguments based on behavioral finance. Some trading strategies based on behavioural finance (momentum and reversal effects) were outlined.
• The chapter concluded by looking at evidence of hedge fund performance, and finally looked at some trading strategies based on so-called algorithmic (program) trading.

**Activities**

1. Describe the efficient market hypothesis. If the efficient market hypothesis is really true, but traders nonetheless keep searching for trading strategies that can ‘beat the market’, do you think they would find useful trading strategies? Suppose we can construct trading strategies that yield ‘symmetrical’ risk profiles where abnormal gains and losses are similar in magnitude and frequency, and strategies that yield ‘asymmetrical’ risk profiles where abnormal gains are small but frequent and losses are large but infrequent. Which strategy do you think we would be more likely to find in an efficient market if we were out to ‘beat the market’?

2. Consider the asset prices given in the table below. One is generated under the efficient market hypothesis and the other is not. Your task is to identify which is which.

<table>
<thead>
<tr>
<th>Asset A</th>
<th>Asset B</th>
</tr>
</thead>
<tbody>
<tr>
<td>100.00</td>
<td>100.00</td>
</tr>
<tr>
<td>98.58</td>
<td>100.25</td>
</tr>
<tr>
<td>97.78</td>
<td>101.57</td>
</tr>
<tr>
<td>99.78</td>
<td>101.62</td>
</tr>
<tr>
<td>97.83</td>
<td>105.35</td>
</tr>
<tr>
<td>99.64</td>
<td>112.38</td>
</tr>
<tr>
<td>101.07</td>
<td>114.89</td>
</tr>
<tr>
<td>102.70</td>
<td>122.21</td>
</tr>
<tr>
<td>99.61</td>
<td>134.35</td>
</tr>
<tr>
<td>102.48</td>
<td>142.81</td>
</tr>
<tr>
<td>106.77</td>
<td>154.47</td>
</tr>
<tr>
<td>109.24</td>
<td>168.91</td>
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<tr>
<td>107.79</td>
<td>184.15</td>
</tr>
<tr>
<td>111.04</td>
<td>191.92</td>
</tr>
<tr>
<td>116.00</td>
<td>196.27</td>
</tr>
<tr>
<td>118.65</td>
<td>200.51</td>
</tr>
<tr>
<td>122.66</td>
<td>199.74</td>
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<tr>
<td>128.39</td>
<td>197.06</td>
</tr>
<tr>
<td>128.30</td>
<td>201.85</td>
</tr>
<tr>
<td>122.00</td>
<td>215.77</td>
</tr>
</tbody>
</table>

3. Now evaluate whether it is possible to make momentum profits by trading the asset you think may not satisfy the efficient market hypothesis in the previous activity.
A reminder of your learning outcomes

Having completed this chapter, and the Essential reading and activities, you should be able to:

- describe fundamental trends in historical mutual fund performance
- confidently explain the efficient market hypothesis and fully distinguish between its many forms
- cogently discuss the existence of common cognitive biases in human information processes, and concisely explain how these biases can lead to effects (momentum and reversals) that violate the efficient market hypothesis
- describe how the effects of momentum and reversals can be translated into profitable investment strategies in detail
- clearly identify distinctive characteristics of 'hedge funds' in the context of the investment management industry
- briefly discuss the problems related to evaluating hedge fund performance
- adequately define 'algorithmic trading' or 'statistical arbitrage.'

Sample examination question

1. a. Explain what we understand by a 'hedge fund'.

b. Momentum and contrarian trading strategies are so-called returns-based trading strategies. Describe what this means in words, and also design a weighting scheme to determine how much to invest in assets based on such strategies.

c. Demonstrate that, if the spreads between two rates or asset prices are identically and independently distributed random variables in successive trading sessions, you make a profit 75% of the time by betting on a reduction in spreads if the current spread is above the average, and on an increase in spreads if the current spread is below the average.