Capital Markets and Investments

Essential Insights and Concepts for Professionals

Siddhartha G. Dastidar

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About the Author

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Dr. Siddhartha Ghosh Dastidar is an Associate Professor (adjunct) at Columbia University, and has taught at the Graduate School of Business and the Department of Industrial Engineering & Operations Research. He teaches courses on capital markets and investments to full-time graduate and undergraduate students, and also in the executive education program.

Sid has nearly two decades of experience in the financial services industry, both buy-side and sell-side, across asset classes and regions. As part of the Quantitative Portfolio Strategy team at Lehman Brothers and Barclays Capital in New York, he has advised large institutional clients on portfolio construction, management and risk budgeting issues. He was also the chief US equity derivatives strategist at Newedge, part of Société Générale. He is currently a risk manager in Brigade Capital, a USD18 billion credit alternatives asset manager, where he has been responsible for coming up with portfolio construction, risk and quantitative frameworks. He has also worked in emerging market private equity for three years.

Sid received a Ph.D. in Finance & Economics from Columbia Business School in New York, a MBA from Indian Institute of Management Ahmedabad and an undergraduate degree in economics from Presidency College Kolkata (both in India). He holds the CFA charter and has published in top journals such as the Journal of Financial Economics and the Journal of Portfolio Management. He has presented at the National Bureau of Economic Research in Boston and at top universities globally. He is a member of the Economic Club of New York.

Reader Comments

Dastidar has put together a concise, very readable book covering the essentials of capital markets and investments. It nicely covers the big three – fixed income, equities, and options – at a mathematical level that is typically just short of using calculus. But what really stands out is the very current discussion of the institutional mechanics behind the markets. Automated trading markets and high-frequency traders get more than a passing mention, and Dastidar details the process of offering new securities and the role of sell-side investment banks. Well worth adding to your investments bookshelf!

- **Charles M. Jones,** ***Robert W. Lear Professor of Finance and Economics***
  Chair, Finance Sub-division, Columbia Business School, New York

This concise book provides a wide perspective on capital markets ranging from asset pricing, and the anatomy of buy and sell side firms, to financial statements and macro-economics. It is ideal for anyone needing a rapid introduction or re-introduction to finance and financial institutions -- students transitioning into a graduate program in financial engineering, or technologist exploring opportunities, or even finance professional transitioning areas.

- **Garud N. Iyengar,** ***Chair and Professor, Department of Industrial Engineering and Operations Research, Columbia University, New York***

An excellent survey of financial markets, explaining in concise language everything from the different asset classes to fixed income and equity markets and portfolio theory. A useful and very practical orientation for finance professionals and students alike.

- **David Weisbrod,** ***former CEO of LCH Clearnet LLC (one of the world's largest clearinghouses) and Vice Chairman of JPMorgan , New York***

Finally, a clear and concise book that uniquely marries sound theoretical constructs with close-up practical insights... an excellent body of knowledge for both students of finance and practitioners in the asset management industry.

- **Adri Guha,** ***Chief Investment Officer, Advanced Portfolio Management (institutional fund-of-funds/ advisory services)***

Siddhartha does an excellent job of mixing finance concepts with real life examples, thus helping build a good foundation.

- **Ajit Agrawal,** ***Managing Director, Investment Research, UBS Securities LLC***

This manuscript is an excellent supplement to the existing textbooks about Investments. It distinguishes itself by concise introduction of the key financial instruments and tools for analyzing them. Big-picture description of the financial system and the role of financial intermediaries is an invaluable feature.

- **Mikhail Chernov,** ***Professor of Finance, Anderson School of Management, UCLA***

This book is written with the student in mind. With clear language and sharp focus on essentials, it feels like learning from a personal tutor.

- **Hayong Yun,** ***Associate Professor of Finance, Eli Broad College of Business, Michigan State University***

Essential reading for anyone looking for a comprehensive introduction to investment management. This book makes quantitative finance accessible by succinctly blending various key aspects of investment management while also describing the pricing and mechanics of common financial instruments and important metrics and models most relevant in finance. Qualitative investors can use it to incorporate quantitative tools into their investment process, and it serves as a helpful refresher for experienced quantitative investors. The annexures contain relevant background including an overview of concepts in accounting, economics and statistics.

- **Tarun Gupta, Ph.D.,** ***Managing Director at AQR Capital Management***

Dastidar's book provides a concise, readable and up-to-date coverage of key capital markets topics. It's perfect for introductory finance classes, and practitioners looking for quick refreshers.

- **John Kiff,** ***Senior Financial Sector Expert, International Monetary Fund***

Capital Markets and Investments provides a comprehensive review of today's capital markets, financial industry structure and the latest theories underlying asset pricing and portfolio construction. Professor Dastidar, based on his experience in both industry and academia, clearly and succinctly explains important concepts without glossing over those essential details that every aspiring market professional must know. The book's logical and topical format lends itself to being used as a handy desk reference.

- **Bruce D. Phelps,** ***Managing Director, Head of Research, PGIM (Prudential Financial's investment management arm, with over USD 1 trillion in AUM)***

Masterful rendering of a complex subject into an easily digested elixir of finance; students will love the rarely-seen practical perspective that Dastidar brings to the topics.

- **Nandu Nayar,** ***Hans J. Baer Chair in International Finance and Chair of the Perella Department of Finance, Lehigh University, PA***

The textbook is like a bible for me.

- ***Anonymous Student, Columbia University, New York***

Table of Contents

About this Book

I have intentionally placed this section after the Table of Contents, because I hope readers will spend a few minutes reading this.

Who is this book for?

This book is meant to help practitioners and students understand the essentials of capital markets, *quickly*. It requires no specific prerequisites, except possibly some fluency in high school/ undergraduate math. Basic information on financial statements and statistics are included in self-contained annexures at the end. The annexures can help bridge any gaps in background that readers may have to understand the content in the body of the book thoroughly and build on it.

Over the years, more people need a rapid orientation in finance:

- Finance professionals need a quick refresher on a market that they do not deal with regularly.
- Professionals with qualifications in other disciplines continue to look to switch careers into finance.
- Students with prior background in another discipline often join a Masters degree program, specializing in finance (MBA, quantitative finance, etc.)
- Advanced undergraduate students want to decide whether finance is right for them.
- Mid-career professionals in another industry, serving financial services clients, need to understand the basics of financial markets better. For example, Fintech professionals with a technology background are looking to connect more with mainstream finance companies.
- Or, it may be a curious individual who simply wants to understand the financial periodicals better, and possibly make more sensible investment decisions!

Practitioners currently employed in the finance profession will find this book useful in refreshing basic concepts in a part of the market they do not deal with regularly. Students of finance will find the book useful in teaching them preliminary/ intermediate ideas, putting facts in context and "connecting the dots".

Because of the book's introductory nature, *it is heavy on principles, mechanics, details, etc. and light on perspective.* This book gives readers the tools to formulate opinions and evaluate the opinions of others, but it does not offer opinions on a platter. The best way to form opinions on the market is to read and assess commonly offered opinions, and assimilate them yourself. This book helps, but the hard work has to be yours.

What makes this book different?

This book scratches the surface of several potentially interesting areas within finance, allowing the reader an informed choice regarding which topics to go deeper. I would recommend most students read this book in its entirety (even if they only care about a few topics) as I consider most of this information essential knowledge for aspiring finance professionals. The first section, in particular, describes the operations of large financial organizations; this is less relevant for finance professionals but will help beginner students (even in interviews!).

As the emphasis is on quick learning, *the book aims to be concise, at the cost of being cryptic* at times. The book avoids detailed explanations and examples of concepts, expecting readers to look that up elsewhere if necessary (many people may not need it), once they have an idea what to look for. At the same time, the book delves into institutional detail not commonly found in textbooks, instead of being merely conceptual, because these details often drive the market dynamics. This book is heavy on jargon, as the biggest hurdles in finance are not the concepts but the vocabulary. Because of the emphasis on brevity, most concepts are introduced but not explained comprehensively.

I wrote this book because I wanted an inexpensive book to introduce motivated readers without a prior background quickly (in a one-semester course for students) to the essential elements of capital markets, while not skipping important (albeit dry) practical details. Finance (and most other fields, from my experience) is much more about gory details than lofty ideas, a perspective lost in most introductory books. Market plumbing matters a lot!

This book will be regularly updated, as the industry is in a state of constant flux. A necessary step in keeping the price low was to publish to book personally, without a large publisher. Hopefully, the content and price more than makes up for the lack of "features" and look-and-feel.

How, practically, to use the book

Readers need to be active participants in the reading and learning process. By itself, the book is unlikely to teach much, because it is cryptic and does not reinforce concepts (a fallout of brevity). This book will especially help participants get a quick overview of a topic before diving deep into it (using some other source). Alternatively, it will help synthesize concepts and reinforce the broad idea after having studied the painstaking details elsewhere.

So, introductory readers would do well to:

- Read unfamiliar material slowly and with deliberation – many sentences are dense and introduce multiple concepts. Re-read; subsequent readings will get easier.
- Take copious notes in the book or elsewhere (and jot down questions for later clarification) while reading the book.
- Have access to the Internet or other references (most concepts are common and easy to find examples and information on) to get more details on any topic that the student finds interesting or relevant. Many topics which the book covers in a sentence or a paragraph need a book to do justice, but that would defeat the objective of being concise and quick, and may be of marginal importance to many readers (and of primary importance to others).
- The index is detailed. If a term is unfamiliar, please consider looking it up at the back to check for another section of the book that explains it in more detail.
- The reference section at the end of every chapter have lists of sources with more details; this may be easier for readers who do not want to search the Internet continually for supplementary information.

Organization and Formatting

Most of the information in the different sections of the book – Institutional Overview, Bond Markets, Equity Markets, Options Markets and Annexures – is independent. I would suggest instructors (and students) sequence the sections whichever order they please, and refer liberally to the relevant Annexures for background detail. There are a few sections on institutional detail in most chapters; this can be skipped in an introductory class, or a first reading. The first section on Institutional Overview can also be treated like a (very large) annexure; while advanced readers can skip it and use it as a reference, introductory readers would do well to go through that material, to understand the building blocks.

I use the male pronoun "he" almost exclusively; I'm not biased against women capital markets professionals, but it's just easier to use one pronoun.

Within a chapter, the headers are organized in the following manner:

SECTION HEADING

Sub-Section Heading

Topic Heading within Sub-Section

Some words in the text are *italicized*, either for *emphasis* or to indicate (the first few times) that it is *financial market terminology*. They mean something precise and are used in a specific context, and may (or may not) be discussed in a later section in the book. Internet searches (or a different part of the book, navigated with the index) can help here to understand the concept better. Sometimes, words are in "quotes", when the meaning is markedly different from regular usage. *Keywords*, often discussed in nearby pages, are highlighted and italicized. Of course, the headings will also contain some keywords, which we will not format distinctively.

This book has a significant amount of material that can be skipped on a first reading or treated like the Appendix. Chapters 3, 4, 5, 6 and 10 are totally optional. Most chapters also have sections with details that can be glossed over initially. These optional chapters and sections have been marked with *"***"* in the relevant headers.

While the book is certainly suitable for a global audience, certain examples and details have taken on a more US-centric tone. Usually, these sections are fairly apparent and disjoint, like the discussion of the US bankruptcy code, and can be easily skipped.

Suggested Teaching Plan

The independent reader can pick and choose which chapters and sections he wants to read. I've made an effort to keep various parts of the book self-contained, while focusing on central themes. Since several professors and students will use this as a textbook, I am taking the liberty of proposing a tangible teaching plan for instructors who wish to cover most of this material in one semester.

This book can probably not replace an extensive textbook with many solved examples and exercises with lots of illustrations, so most instructors who have a workflow that they are happy with will find it easiest to assign this book as a supplementary text. But, for

Instructors can either assign Chapter 1 and 2 (and Annexure I) as prior background reading, or cover them in an introductory session. Students should be required to go through the annexures on their own, at least to be familiar with the concepts so that they can return to the back when necessary. Classes with a more quantitative background can begin with fixed income (Chapters 7, 8 and parts of 9), where the concepts are more tangible, before transitioning to equities (Chapters 11 and 12) and ending with options (Chapters 13 and 14). Classes where the emphasis is predominantly on qualitative insights will find it more natural to cover the equities section first, before fixed income and finally options.

Chapters 3, 4, 5, 6 and 10 are completely optional; one can visualize them as an extension of the Appendix section. Further, many chapters (especially Chapter 9) have a few sections which can easily be skipped, adding to the "list" of optional topics. These sections have been marked with "***" in the respective headers.

1. The Financial System – Introduction

WHAT IS THE FINANCIAL SYSTEM? WHY DOES IT EXIST?

The financial system exists to "match the forces of thrift and productivity". Innovative entrepreneurs, growing companies, and other "producers" of goods and services need "capital" to achieve their goals (i.e. "projects"); these projects, if successful, will generate positive cash flows (i.e. revenues, net of costs) in future. The producers themselves sometimes invest part of this capital, but the vast majority of this capital is sourced from external sources – banks, equity markets, bond issuances, etc. This capital eventually comes from private savers (or, sometimes from government incentive schemes). These investors (i.e. savers) have more capital than they currently need and invest in the projects promoted by the producers, in the hope of achieving a return (hopefully large, and at least positive!). The investors are promised a portion of the project's future cash flows and get paid back if and when the project does well. In a broad sense, the "producers" are also investors; they invest primarily by providing their time, skills and effort, and they too share in the returns of the project. As we start thinking generically, these distinctions between external investors, the project sponsor, employees, etc. begin to blur, and we refer to all of them as stakeholders.

These projects have uncertain outcomes – some will succeed beyond their wildest expectation (think *Facebook* or *Google*), and others will fail. The returns that the investors *expect* (or demand) to earn depends critically on the risks that they perceive in the project or company that they are investing in. Of course, the return that investors end up earning can be very different, depending on how well the project performs; there is no absolute guarantee. What happens when there is too much capital for all the available projects/ investments? In that situation, the producers will be able to raise their target capital by promising a lower share of the project proceeds than they would normally need to, and external investors will be forced to accept a lower rate of return.

For the financial system to function, several agents have to play important roles, and act as facilitators. For example, the investors and the producers have to find each other. In a simple world, we can think of a massive database where they are all listed, and people find each other. In fact, in many ways, we are coming full circle, with platforms such as Kickstarter and LendingTree trying to do exactly that (or at least part of it, where projects are listed and investors scan them); in finance terminology, this is an example of *disintermediation* (regular middle-men/ firms are being eliminated because of market changes). But, it's apparent that this cannot be a one-size-fits-all solution, as many projects are complex, require large sums of money, significant amounts of fact checking, etc. This requires several intermediaries. Further, if different investors have cash flow needs at different times, certain other intermediaries facilitate transfer of the rights to the project cash flows to a new investor by paying out the earlier investor.

The Financial System comprises:

- ✓ Entrepreneurs/ Project Owners who have ideas but need capital to produce future cash flows
- ✓ Investors with capital to invest, who expect to earn returns (receive future cash flows)
- ✓ Intermediaries that help
  - investors and producers transact with one another (invest capital today for future cash flows)
  - transfer risk from one investor to another, after the initial transaction with the producer.

KEY PLAYERS IN THE FINANCIAL SYSTEM

The most important part of the financial system is, arguably the commercial banks, who accept deposits from savers, and use these deposits to make loans to businesses and individuals. The fractional reserve system (banks need to hold only a small fraction of the money they raise through deposits, and can lend the remaining) allows banks to lend out many multiples of the deposits they receive, effectively increasing the money supply if there is demand for loans. With commercial banks, both the provider of capital (i.e. the saver) and the borrower of capital face the bank (and are exposed only to the risk of the bank not honoring its obligation). In many markets, especially the US, the capital markets supplement the role of banks as a distributor of capital, where investment banks serve mainly as a facilitator and the provider and user of capital face each other. We will not focus on commercial banks in this book.

The market for raising capital, where money flows to the producer from the investor, is referred to as the *primary market*. Some intermediaries are responsible for getting these projects/ ideas/ companies in front of the investor audience for the first time. These are the origination/ *investment banking*/ corporate finance/ M&A divisions of investment banks; they may be parts of large "bulge-bracket" houses or smaller "boutique" shops (part of the *sell-side*). We will discuss them (and all the other players we mention here) in later chapters, but it should be apparent that these divisions need to have deep relationships with both the producers (i.e. entrepreneurs and companies who engage them to raise money for their projects) and the investor community who rely on them to get opportunities to invest in these projects.

Along with the investment bankers, several other players play an important facilitating role. *Accounting firms* vet the books and records of the firms that are trying to raise capital, *regulators* check to make sure that appropriate information is disclosed to every party at the same time, all investors are treated fairly, etc. *Lawyers* are involved in drafting legal agreements between various parties (e.g. investors and entrepreneurs/ companies) and making sure that all documents are filed properly with regulators, etc. Of course, the specifics of the role of the investment banks and the other players depend crucially on the exact type of project, and the instrument for raising money/ paying back investors later – is it a start-up raising venture capital, a large company filing for its IPO, an organization doing a bond issuance for a M&A, whether the investment is open both to large investors and retail accounts, etc. *Rating agencies* assess the risk of the projects/ companies and express the risks on a scale relative to other available investment opportunities.

The *investors (i.e. the buy-side)* are responsible for investing capital judiciously by taking measured risks. At any time, they are expected to compare the risk-return tradeoffs of alternative investment prospects to choose the investments that appear most attractive in their investment universe. Most of the book deals with this issue and discusses some standard frameworks that investors follow, to map investment opportunities on the risk-reward spectrum. Given the plethora of opportunities, much of this analysis is often initially reduced to a set of metrics. For the potential opportunities that pass this initial screen, a deep-dive may be conducted, depending on the investment philosophy of the investing firm.

As alluded above, if too many investors show interest in a certain investment proposal, the project company has the luxury of changing the terms of the investment (of course, before money changes hands and terms are agreed to), to either part with a smaller proportion of future cash flows to external investors, or raise more money than originally planned for the same cash flow proportion as earlier. As a result, the original return (i.e. expected future cash flows, suitably adjusted for the delayed gratification of receiving money later, as a proportion of current investment) gets reduced, and some investors drop out of the bidding process, until the supply of capital to the project at the current terms matches what the producers want the raise at the same terms. But, on several occasions, the sponsors of a "hot" investment will change terms only slightly, allowing the deal to remain "oversubscribed", with only some of the interested investors eventually to get an "allocation" (i.e. "participate in the deal). This scarcity of the opportunity to invest in the proposal creates buzz, which also allows the secondary market (described below) in the name to do well.

The primary market facilitates the allocation of risk capital to (potentially) future cash flow generating projects. But, if this were the only market, then the investors would need to part with their capital for the duration/ time horizon of the project, or until all promised cash flows are paid back, which may take decades. Meanwhile, the risk characteristics of the project may change because of market conditions. Also, since most projects take several years to mature, investors with short-term capital (e.g. available for six months to three years) would find it difficult to invest.

The *secondary market* addresses this issue; in this market, risk is transferred from one investor to another; the producers or the project sponsors do not usually participate in this market. After an instrument is issued, current holders of the security who want to sell it are matched with prospective buyers in the secondary market. Depending on the trading mechanism of the particular instrument, brokers can play an active role here, by finding buyers and sellers, and providing a layer of anonymity. An active secondary market allows investors to have a flexible time horizon, and allows them to exit a position based on liquidity needs or current attractive valuations. It also allows speculators to participate, providing another source of liquidity.

- ✓ Investors and Corporations/Project Owners transact in the primary capital markets.
- ✓ Investors trade (i.e. exchange these claims to future uncertain cash flows for certain cash today) with other investors in the secondary market.

SPECIALIZATION WITHIN THE FINANCIAL SYSTEM

In case it hasn't been clear, the investment world is very specialized (we have an entire chapter on this). There are various kinds of contractual terms/ structures that project companies typically use to raise capital (most obviously debt and equity, but there are many sub-classifications too). Each of these financing structures requires different *risk appetite*, and different analytical skill-sets, even if the underlying project proposal is the same. Even for investment firms that want to invest across the risk spectrum, analyzing investments in different industry sectors or geography require domain knowledge in every sector or region, providing a natural reason to specialize. Since the investment banking world depends on relationships, this specialization effectively partitions the sell-side too.

Additionally, the risk appetite is often driven by the exact source of the investment firm's capital. For example, a fund that is capitalized by 401K money (i.e. individual retirement plan money) is likely to have a conservative mindset, but also have a long investment horizon. High-net-worth individuals often invest through Registered Investment Advisors (RIAs) and are very sensitive to tax rates. A pension fund of a state/ corporate has fairly well-defined future liabilities because of defined benefit pension plans of its employees, and needs to invest with that in mind. An insurance company has a long-horizon perspective, makes money primarily from its insurance underwriting business and has more of a "preservation of capital" mindset. A corporate treasury may have specific time-sensitive needs and invest accordingly. The source of capital drives investment philosophy, risk tolerance and defines the investment universe.

Within the buy-side too, there is a layer of intermediation. There are institutions and individuals that have capital to invest, and there are investment managers who are skilled in the profession of investing capital in the financial markets. A capital owner would ideally like the most capable investment manager to invest on his behalf. For most investment firms, it is easier to claim expertise in a focused niche, than broad-based superiority. Since capital owners can easily use multiple investors to invest in different markets, the best-of-breed specialization has become dominant among investment managers.

As we discuss specialization within the financial system, it is important to recognize that many of these businesses do not need massive investments in physical capital, decades to build, and armies of people. A handful of smart seasoned people, focused on the specific market, can play a meaningful role in this chain of value-creation. Formally, these specialized individuals may be a separate stand-alone firm, or work within the boundaries of a larger firm, so a larger broad-based firm will often have smaller dedicated teams, often working in silos (which could easily fit into another firm instead). The performance of these focused teams is relatively easy to isolate; both these issues lead to the apparently large compensation bonuses that the press reports.

The current financial system is a loosely connected set of silos. Sometimes these silos occur within a large organization, and sometimes they are stand-alone. Each of these set-ups has its own costs and benefits. While assessing these systems, it is important to understand how each of these agents gets compensated, because that ultimately points to the biases of these players.

The financial system is extremely specialized:

- ✓ Different contractual structures allocate risk differently between company and investor
- ✓ Different capital owners have different risk tolerances
- ✓ Investment managers specialize by skill sets and the part of the financial markets they focus on
- ✓ Many financial services businesses have low capital intensity, and can be set up in a lean format
    - Silos can be are often spun out as separate businesses

PRINCIPLES OF PRICING FINANCIAL INSTRUMENTS

This book is about the financial capital markets, which primarily deals with how instruments are traded and priced. We will get into lots of details, mechanics and conventions in the later chapters, but there are a few basic considerations that are worth introducing early.

- The *Time Value of Money* is based on the idea that the same dollar amount paid out at different times in the future has different values today, since money received earlier can be re-invested to earn interest for a longer period. More formally, cash flows to be received at different (future) points in time can be *discounted* to an equivalent present value (or discounted to any other future period), by applying the principles of compound interest. Algebraically, a cash flow of C dollars paid out after i periods from now is worth P today, where $P = \frac{C}{(1+r)^i}$, and r is the interest rate (per period) that an investor can earn by investing money today for i periods. P dollars can be invested today and compounded at r% per period (often a year) to result in C dollars at the end of i periods, so P dollars today is equivalent to C dollars i periods later, if the market interest rate is r. Importantly, in addition to the time valute of money, the rate r should also reflect the risk (uncertainty) of receiving the cash flow C; the greater the risk, the higher should be the interest rate used to discount the cash flows. *Net Present Value (NPV)* and *Internal Rate of Return (IRR)* are important concepts based on this idea; readers should refer to Annexure 1 for further information.
- Investors can either take long or short positions in securities. Buying a security is often referred to as going *long* the security. Investors get long a security when they expect its price to go up (i.e. feel "*bull-*

ish"); a buyer's aim is often to buy the security at a low price, and sell it at higher price, while collecting any interim cash flows that the security pays while he owns the security. Conversely, an investor takes a *short* a position in a security when he feels that the security is likely to go down in price (i.e. feel "*bear-ish*"). This position has diametrically opposite risks to the long investor; the investor benefits from a short position when the price goes down, and loses when it goes up. This is mechanically achieved by selling a security without owning it first, by *borrowing* the security from a *securities lending program* and then selling it. The short "seller" receives cash flows from this initial sale (in reality, these proceeds effectively serve as *collateral* to the lender of the security, and may earn a small interest), and plans to buy back (i.e. *cover*) the security hopefully at a lower price, to earn the difference between the initial sale price and the later covering (i.e. purchase) price. During this time, the short seller needs to pay the security's original owner any cash flows that the security pays during this period, and also a per-period security borrowing cost (and receives a small interest payment on the collateral), so it is costly to be short for an extended period, since there is a recurring cost every day. If the security's price goes up after the short, it is terrible for the short since now the security has to be bought back at a higher price. Further, if the seller chooses to stay in the position, the earlier collateral is now inadequate and needs to be replenished, since a more expensive asset needs to be secured.[1]

As we will learn later, most of the world's financial assets are managed through *long-only* accounts such as mutual funds, so the concept of shorting securities is only directly relevant to a small investor base. But, it is an important mechanism to keep asset prices fair, as some (large) investors can definitely short if prices get too high. If no investor was allowed to short securities, prices could theoretically get higher from fair value and remain high, driven by either speculators betting on even higher prices, or by investors with different opinions about future prospects. We discuss shorting in more detail, in the section on prime brokerage in Chapter 3.

- The *principle of no-arbitrage* emphasizes that if a security A has the same cash flows as security B in every possible future period (or state), they will have the same price today. Otherwise, an investor could short the more expensive security (based on today's price) and buy the cheaper security simultaneously and lock in a profit upfront, with all subsequent cash-flows offsetting each other. This principle is also important in pricing securities – if a security's cash flows can be replicated using a portfolio of other securities with known prices, this security's fair price can be calculated using those known prices.

  More formally, an arbitrage is said to exist when an investor receives some (positive) cash inflow today, with zero probability of having to pay more than that amount (adjusted for time value of money) in future. Alternatively, the investor enters the position today at zero cost, with at least some probability of getting a positive cash inflow in future, and zero probability of a cash outflow in future.

  > To build on the topic about pricing securities using replication/ no arbitrage, let us consider the following *example*:
  >
  > Let us consider a world with three time periods – 0 (today), 1 and 2. The payoffs of instruments A, B and C are given below. The prices of B and C are known, the price of A is to be determined. Figure 1.1 shows these prices and payoffs.

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[1] This *long/short* terminology gets more confusing for *unfunded* positions since no cash is exchanged upfront; the convention is to look at the direction of risk exposure to determine the long or the short side.

Figure 1.1 Prices and Payoffs of Instruments A, B and C

Asset	Price Today	Payoff Period 1	Payoff Period 2
A	??	250	250
B	450	500	0
C	410	0	500

It is apparent, from the table above, that two units of instrument A will pay off exactly the same amount in each period as the total of one unit of B and one unit of C. So, two units of A should cost (today) the same as a portfolio comprising one unit of B and one unit of C (since they provide exactly the same cash flows in future), or one unit of A should cost 430 [i.e. 0.5*(450+410)] today. If the market price of A is anything else, there will be a potential arbitrage opportunity.

To elaborate, suppose, for example, the market price of A is 460 and the other values are as above. In this situation, an investor would sell (short) 2 units of A, receive 920 in sales proceeds and spend 860 of that to buy one unit of each of B and C. The investor collects 60 today, and his future liabilities (by selling A) are exactly matched by cash inflows from B and C[2]. This seems like a way to make money for free without taking any risk; such opportunities should not exist in an efficient market.

Such situations are rare in the real world. When they do occur, it usually either represents hidden (cash flow) risk or because transaction costs are high/ the security to be shorted is in limited supply, driving up the borrow cost, so the arbitrage may not be compelling after considering all costs fully.

- The example above discussed securities whose cash flows were known with certainty. To extend this principle to instruments with uncertain cash flows, we introduce the concept of *risk-adjusted returns*, which formalizes the notion that securities with higher risk (uncertainty of future return) should earn higher returns (as we discussed above). How exactly to measure the risk and how to translate the extra risk into additional expected return is more an art than a science; models/ frameworks can help with the initial steps. Investors should principally be keen to invest in the securities with high risk-adjusted returns (if they believe in the risk adjustment methodology), because that's where they are supposedly getting the best deal beyond being compensated for taking on the risk.
- Stated simply, the underlying goal of all investing is to buy securities that are likely to gain in value, and sell/ short securities that are more likely to lose value. Now, today's market valuation reflects the future outlook of securities, so it is often not enough to simply assess whether the underlying company's/ country's future prospects are positive or not. It is essential to form an opinion on the future outlook relative to the market's view of the same company/ country, so it is crucial to figure out *what outlook is priced into current market prices*. Often the outlook priced in is a (probability-weighted) average of the security prices in various scenarios; if the investor feels differently about the likelihood various scenarios that could possibly play out, that insight is sometimes adequate to put on a trade.

[2] In reality, the investor would need to borrow A from a securities lending program through his broker, pay a borrow cost, and put up collateral, maybe including the assets B and C that he purchased, reducing the profits from the trade. There is also usually a bid-offer spread which we will discuss later. There are some popular examples of such trades not working out, such as the Palm spin-off from 3Com in 2000 and the VW-Porsche deal in 2008.

Some Basic Principles and Terminology:

- ✓ The Net Present Value (NPV) and Internal Rate of Return (IRR) concepts to evaluate investments are based on Time Value of Money, which requires project cash flows to be discounted to adjust cash flow dollars paid at different times to make them equivalent and comparable.
- ✓ Investors who are optimistic go long (or buy) a security; pessimists go short (or sell). A short seller needs to locate a security to borrow and pay the borrow cost, and pay any intermediate cash flows (e.g. coupon or dividend). The short position is eventually closed out by covering.
- ✓ No-arbitrage principles suggest that asset markets should be efficient and it should not be possible to make money without taking risk. Risk-adjusted returns indicate a security's performance after adjusting for the risk the investor takes to invest in it.

ARE FINANCIAL MARKETS "EFFICIENT"?

How well do the principles described in the last section (no arbitrage, short selling, risk-adjusting returns, etc.) apply in practice? How accurately do current market prices of financial securities reflect their future potential returns? The *Efficient Market Hypothesis* says that security prices immediately adjust to incorporate new information, which arrives randomly. To be clear, *this is merely a hypothesis*; staunch believers will feel that there is no point trying to pick securities in the market (because price movements are random); arbitrage opportunities will exist if the market is not efficient. Securities are all fairly valued, and holding the entire market index is the best bet. We discuss the Random Walk model in the section on option pricing, which is based on this fundamental idea. At the other end of the spectrum, non-believers insist that the market is inefficient because of various reasons (illiquidity, regulatory constraints, capital/ position-based limits to arbitrage, too much information and being able to sort it all out, behavioral biases, entry barriers in terms of deep domain knowledge, etc.), so price movements can be predicted with some degree of success. This fundamental question is not addressed in this book, but the truth is probably somewhere in between.

Efficient Market Hypothesis

There are a few "versions" of the Efficient Market Hypothesis, which we are touching on mainly to introduce terminology. It's a matter of choice what readers choose to believe; but be aware that believing in the strongest form of the statement is inconsistent with being an ardent bottom-up stock picker.

The *Weak Form Efficiency* is the weakest form of the hypothesis, which says that historical prices and volume data are not useful in predicting returns. The implication of this is that technical analysis should not work. Momentum has been one of the strongest predictors of returns over the past several decades (before it got too common and algorithmic over the last few years), so even the simplest form of efficiency has some evidence against it. Studies on serial correlation of securities have demonstrated some short term persistence, but transaction costs are too great to profit from it. Further, for every theory like momentum, there is an opposite theory like *Mean Reversion*. One of these is always going to be true, tautologically. Analysts often say that mean reversion is a longer term phenomenon, whereas momentum is shorter term, but the horizon is tricky to define. With the advent of technology, these time horizons are likely getting shorter and more random.

Semi-strong form Efficiency implies that prices incorporate all publicly available information, not just historical prices and volume. So, this implies that none of the fundamental and technical analysts add incremental value. It is possible that the same information may be interpreted differently by different analysts, or there may be some information that most analysts haven't chanced upon; this version of efficiency does not allow for that too. Most analysts will believe that this version of efficiency does not always hold.

Strong-form Efficiency insists that even with private information, it is not possible to predict security returns; this is probably a stretch.

The core argument justifying market efficiency is that there are millions of investors and analysts following financial markets, several hundred track any particular focus area. If a security's price were obviously wrong, capital would flow in / out of that security until the price reflects fair value. In particular, investors could put on arbitrage strategies and lock in profits if prices are not aligned with the economic reality.

Whichever version one chooses to believe in, it is indeed true that new public information is getting disseminated and incorporated in prices very rapidly, so the edge to analyzing information may be going down; in fact speed may even lead to misinterpretation and present an opportunity. Further, many pricing anomalies may appear to exist or investment opportunities appear lucrative, but they are either transient, or may not be thoroughly researched or may reflect (incorrectly assessed) investment risk. So, in a sense, recognizing that the market may plausibly be somewhat efficient overall should cause the investor to ask why the other person wants to sell when the investor wants to buy (or vice versa) and convince himself that he is not missing anything.

Counterclaims to Market Efficiency

Theories of Asymmetric Information - Agency Theories

Efficient market theories are based on frictionless markets, with all players having the same information (among other assumptions), consistent with perfect competition. In both the retail and the institutional investment world, professional investment managers manage most of the financial capital on behalf of their clients (who own the capital), as we elaborate in Chapter 4. In the real world, the entity owning the capital (principal) cannot precisely observe if the manager deploying the capital (agent) is doing an earnest job to create value, or doing "just enough" to maintain a good impression or taking excessive risk to get paid incentive fees[3]. So, the capital owner often decides on the performance of the agent based on returns over a certain pre-specified time horizon. This also motivates the creation of investment guidelines, which restricts the agent's investment universe to his stated expertise. This leads to the frictions discussed in the justification for limits to arbitrage, below.

Limits to Arbitrage

The first line of skepticism to market efficient arguments is that it is not easy to implement arbitrages as the textbooks will have readers believe. This is because of investor guidelines (limiting which assets investors can invest in), short selling constraints, lack of borrow availability/ cost of borrow, prices deviating even more from fundamentals in the short run, high transaction costs, short investment horizons aligned with investor performance evaluation cycles, etc. The counter to this argument is that, for arbitrage to disappear, not all investors need to be adept at implementing arbitrage trades; one large investor with the capital and flexibility should be able to drive out mispricing and profit from it. Said differently, if prices reflect a weighted-average of trader beliefs, an arbitrageur, because of reasons above, may not be in a position to build a large enough position to influence prices significantly, leading to the persistence of a potential arbitrage opportunity.

[3] This line of thinking was pioneered by Michael Spence, George Akerlof and Joseph Stiglitz in the early 1970s, for which they won the Nobel Prize for Economics in 2001. This (asymmetric information) problem can be mitigated by signaling (where the informed party takes a costly action to credibly disclose private information) or screening (where the uninformed party presents the informed party with a menu of choices; the pick from the menu reveals the private information).

Further, most mispricings do not show up as textbook arbitrages (where one makes certain money, or has a zero probability of losing and a non-zero chance of making money) but show up as lucrative trades in an expected value framework (high positive expected values). So, while putting on such trades, there remains a non-zero chance of losing (potentially large amounts of) money; investors may be reluctant to allocate massive amounts of capital to such trades, and invest only in small size in a risk-controlled manner. And, if new capital flows to investors with views divergent from the arbitrageur, the arbitrageur will find himself on the wrong side of the trade, in the short term.

Principal-agent issues also make risk-control issues especially important. This is because the capital owner cannot precisely monitor the investment manager's actions, so needs to come up with a contract to create a suitable incentive structure. Now, such contracts can also lead to perverse incentives, so the contract usually also contains guidelines to restrict the manager's actions. Even in the absence of such contracts, the manager may choose to "play it safe" instead of putting on (potentially risky and contrarian) arbitrage trades, which may lead to large losses and stick out, leading to the capital owner firing the manager.

Behavioral Biases of Investors

All the arguments put forward in this chapter (and in most of the book) assume that investors behave rationally, based on the information at their disposal. Studies have shown that this is not always true[4]. Individual (and institutional) cognitive biases lead to non-rational judgments and decisions, which affect trading dynamics and market prices. These biases can broadly be classified as either related to overconfidence, or limited cognitive processing[5] (e.g. simplifying decision-making by using quick heuristics, feelings short-circuiting well thought-out decision frameworks).

Overconfidence leads to investors believing that their estimates are much more precise than reality, their ability is higher than that of their peers; they selectively pick facts to reinforce these biases. This causes investors to trade aggressively, invest actively instead of indexing (Chapters 4, 5). Overconfidence also leads to over-reaction in prices which eventually corrects, leading to short-term momentum but longer term mean-reversion (Chapter 12). This may also show up in large investment allocations to local assets or own-company stock.

Limited focus and mind space to absorb/ analyze information also causes people to ignore information for pricing financial assets. For example, investors overreact to salient or recent information, and de-emphasize less salient information. Investors' subjective probabilities of events are influenced by how easily they can think of examples. Investors often frame the decision problem narrowly, leading them to ignore relevant investment aspects such as employer 401k matches, tax implications or diversifying characteristics to overall portfolios. Investors have been shown to usually simply default to an equally weighted average of securities in their portfolio, without due consideration to risk. Reference points seem to matter to investors, be it the price at which they acquired a security in the past and their aversion to sell losers, their anchoring to initial ideas and premises, mentally compartmentalizing using quick heuristics to get to an answer rather than deliberating fully on the problem. These biases slow down the incorporation of information into market prices.

To summarize, it's probably fair to say that most of the market behaves in a (more or less) efficient manner most of the time. But, for the other times (and parts of the market), behavioral biases become important in

[4] While several researchers, beginning with Savage and Ellsberg have documented investor irrationality in various forms, Daniel Kahneman and Amos Tversky provided the Prospect Theory to explain some of these behavioral patterns, for which Kahneman shared the Nobel Prize in 2002

[5] A strand of academic literature in microeconomic theory refers to this phenomenon as *bounded rationality*.

determining/ explaining the final outcome. And, these effect of these biases may linger, because of agency effect and the resulting limits to arbitrage. Reinforcing behavioral actions by groups of investors (rather than individuals) can also affect prices. Some investors may be in a position to exploit these inefficiencies at the margin, at least temporarily.

Are Markets Efficient?

✓ *Yes*: Efficient Markets Hypothesis
  - Many analysts continuously analyzing information, to find money-making opportunities

✓ *No*: Limits to Arbitrage, Agency Theories and Behavioral Biases
  - Delegating to outside managers, investment rules and risk budgets allow arbitrages to persist.
  - Investors have common behavioral traits such as overconfidence and limited attention, which make them vulnerable to biases.

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