

## Introduction

### What Finance is All About

Finance is such an important part of modern life that almost everyone can benefit from understanding it better. What you may find surprising is that the financial problems facing *Intel* or *Microsoft* are not much different from those facing an average investor, small business owner, entrepreneur, or family. On the most basic level, these problems are about how to allocate money. The choices are many: Money can be borrowed, saved, or lent. Money can be invested into projects. Projects can be undertaken with partners or with the aid of lenders—or avoided altogether if they do not appear to be valuable enough. Finance is about deciding among these and other investment alternatives.

### 1.1 The Goal of Finance: Relative Valuation

There is one principal theme that carries through all of finance: *value*. What exactly is a particular object worth? To make smart decisions, you must be able to assess value—and the better you can assess value, the smarter your decisions will be.

The main reason why you need to estimate value is that you will want to buy objects whose values are above their costs and avoid those where the situation is the reverse. Sounds easy? If it were only so! In practice, finding a good value (**valuation**) is often very difficult. But it is not the formulas that are difficult. Even the most complex formulas in this book contain just a few symbols, and the overwhelming majority of finance formulas use only the five major operations (addition, subtraction, multiplication, division, and exponentiation). Admittedly, even if the formulas themselves are not sophisticated, there are a lot of them, and they have an intuitive economic meaning that requires experience to grasp. But if you managed to pass high-school algebra, and if you are motivated, you will be able to handle the math. Math is *not* the real difficulty in valuation.

It is in the real world that the challenging difficulties lie, beyond finance theory. You often have to decide how you should judge the future—whether your gizmo will be a hit or a bust, whether the economy will enter a recession or not, where you will find product markets, how you can advertise, how interest rates or the stock market will move, and so on. This book will explain what you should forecast and how you should use your forecasts in the best way, but it mostly remains up to you to make these forecasts. Putting this more positively, if forecasts and valuation were easy, a computer could take over this job. But this will never happen. Valuation will always remain an art and a science, which requires judgment and common sense. The formulas and finance in this book are necessary tools to help you convert your reasoned, informed, and intuitive assessments into good decisions. But they are not enough.

Theme number one of this book is value! Make decisions based on value.

Everyone needs to know how to value objects.

The tough aspect about valuation is the real world, not the theory.

## The Law of One Price

The law of one price. Valuing objects is easier in relative terms.

So how do you assess value? Most of finance and thus most of this book is based on the **law of one price**. It states that two identical items at the same venue should cost the same. Otherwise, why would anyone buy the more expensive item? This means that value in finance is defined in *relative* terms. The reason is that it is easier to determine whether an object is worth more or less than equivalent alternatives, than it is to put an absolute value on it.

A car example.

For example, consider the value of a car—say, a 2013 Toyota Camry—that you own. If you can find other cars that are identical to your Camry—at least along all dimensions that matter—then it should be worth the same and sell for the same price. Fortunately, for a 2013 Toyota Camry, this is not too difficult. There are many other 2013 Toyota Camries, as well as 2012 Toyota Camries, 2014 Toyota Camries, and 2013 Honda Accords, that you can readily buy. If there are 10 other exact equivalents on the same block for sale, your valuation task is outright trivial.

Mistakes, both too low and too high, are costly.

What would happen if you make a mistake in valuing your Camry? If you put too low a value on your car, you would sell it too cheaply. If you put too high a value on your car, you would not be able to sell it at all. Naturally, you want to get the value right.

Don't forget about "opportunity costs."

A related way of thinking about your Camry versus the alternatives is that your Camry has an "opportunity cost." Your ownership of the Camry is not free. Ignoring transaction costs, your opportunity is to sell your car and purchase another Camry, or Accord, or anything else with this money. Let's say that the Accord is your alternative, and it is equivalent in all dimensions that matter. If someone were to offer to pay \$1,000 above the Accord value for your Camry, the price would be above your opportunity cost. You should then sell the Camry, buy the Accord, and gain \$1,000.

Approximations: Similar goods that are not perfectly the same.

The law of one price rarely applies perfectly. But it often applies imperfectly. For example, your Camry may have 65,334 miles on it, be green, and be located in Providence, RI. The comparable cars may have between 30,000 and 80,000 miles on them, come in different colors, and be located all over (say, in Los Angeles, CA). In this case, the law of one price no longer works exactly. Instead, it should hold only approximately. That is, your car may not be worth the same exact amount as your comparables, but it should be worth a similar amount, perhaps using a few sensible price adjustments.

More Perfect Markets.

Would it be easier to estimate the value of your car if shipping and repainting cars were free? Yes, because there would be thousands of similar cars now, and many more (possible) buyers and sellers and recent transactions. In finance, the concept of a "perfect market" contemplates such an idealized world—not because it is realistic, but because understanding pricing is easier. Of course, after you have a perfect-market estimate, you then have to contemplate realistic shipping and painting costs.

In the absence of similar objects, valuation is more difficult.

The task of valuing objects becomes more difficult when you are unable (or not allowed) to find similar objects for which you know the value. If you had to value your 2013 Camry based on knowledge of the value of plasma televisions, vacations, or pencils, then your valuation task would be much more difficult. Common sense implies that it is easier to value objects relative to close comparable objects than to objects that are very different. In the real world, some objects are intrinsically easy to value; others are not.

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**Q 1.1.** Discuss how easy it is to put a value on the following objects:

1. An envelope containing foreign currency—say, 10,000 euros
2. Paintings
3. The Washington Monument
4. Manhattan

5. The Chrysler Building in New York
  6. The U.S. Presidency (or a Senate seat).
  7. Foreign stamps
  8. Love
  9. Yourself
  10. The species chimpanzee, or the Yangtze river dolphin
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## 1.2 Investments, Projects, and Firms

The most basic object in finance is the project. As far as finance is concerned, every **project** is a set of flows of money (**cash flows**). Most projects require an upfront cash outflow (an **investment** or **expense** or **cost**) and are followed by a series of later cash inflows (**payoffs** or **revenues** or **returns**). It does not matter whether the cash flows come from hauling garbage or selling Prada handbags. Cash is cash. However, it is important that all costs and benefits are included as cash values. If you have to spend a lot of time hauling trash, which you find distasteful, then you have to translate your dislike into an equivalent cash negative. Similarly, if you want to do a project “for the fun of it,” you must translate your “fun” into a cash positive. The discipline of finance takes over after all positives and negatives (inflows and outflows) from the project “black box” have been translated into their appropriate monetary cash values.

To value projects, make sure to use all costs and benefits, including opportunity costs and pleasure benefits.

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### The Joy of Cooking: Positive Prestige Flows and Restaurant Failures

In New York City, two out of every five new restaurants close within one year. Nationwide, the best estimates suggest that about 90% of all restaurants close within two years. If successful, the average restaurant earns a return of about 10% per year. One explanation as to why so many entrepreneurs are continuing to open up restaurants, despite seemingly low financial rates of return, is that restauranteurs enjoy owning a restaurant so much that they are willing to buy the prestige of owning one. If this is the case, then to value the restaurant, you must factor in how much the restauranteur is willing to pay for the prestige of owning it, just as you would factor in the revenues that restaurant patrons generate.

This does not mean that the operations of the firm—issues like manufacturing, inventory, sales, marketing, payables, working capital, competition, and so on—are unimportant. On the contrary, these business factors are all of the utmost importance in making the cash flows happen, and a good (financial) manager must understand them. After all, even if all you care about are cash flows, it is impossible to understand them well if you have no idea where they come from and how they could change in the future.

What is in the black box “project” is not trivial, but we won’t cover much of it.

Projects need not be physical. For example, a company may have a project called “customer relations,” with real cash outflows today and uncertain future inflows. You (a student) can be viewed as a project: You pay for education (a cash outflow) and will earn a salary in the future (a cash inflow). If you value the prestige that the degree will offer, you should also put a cash value on it. Then, this too will count as another cash inflow. In addition, some of the payoffs from education are metaphysical rather than physical. If you like making friends in school or if knowledge provides you with pleasure, either today or in the future, then education yields a value that should be regarded as a positive cash flow. (The discipline of finance makes it easy on itself by asking *you* to put a hard cash value number on these or any other emotional factors.) Of course, for some students, the distaste of learning should be factored in as a cost (equivalent cash outflow)—but I trust that you are not one of them. All such nonfinancial flows must be appropriately translated into cash equivalents if you want to arrive at a good project valuation.

Cash flows must include (quantify) nonfinancial benefits.

In finance, firms are basically collections of projects.

In finance, a **firm** is viewed as a collection of projects. This book assumes that the value of a firm is the value of all its projects' net cash flows, and nothing else. Actually, the metaphor can also extend to a family. Your family may own a house, a car, have tuition payments, education investments, and so on—a collection of projects.

### Debt and Equity

The firm is the sum of all its inflows and all its outflows. Stocks and bonds are just projects with inflows and outflows.

There are two important specific kinds of projects that you may consider investing in—**bonds** and **stocks**, also called **debt** and **equity**. These are financial **claims** that the firm usually sells to investors. As you will learn later, you can mostly think of buying a stock as the equivalent of becoming an owner. You can think of buying a bond as the equivalent of lending money to the issuer. In effect, a bondholder is just a creditor. For example, a firm may sell a lender a \$100 bond in exchange for a promised payment of \$110 next year. (If the firm were to perform poorly, the bond would have to be paid off first, so it is less risky for an investor than the firm's equity. However, it has limited upside.) In addition, the firm usually has other obligations, such as money that it has to pay to its suppliers (called "payables"). Together, if you own all outstanding claims on the firm, that is, all obligations and all stock, then you own the firm. This logic is not deep—simply speaking, there is nobody else: "You are it."

$$\text{Entire Firm} = \text{All Outstanding Stocks} + \text{All Outstanding Liabilities}$$

As the 100% owner of a firm, you own all its stocks, bonds, and other obligations. Your entire firm then does its business and hopefully earns money. It does not need to pay out immediately what it earns, though. It can reinvest the money. Regardless of what the firm does, you still own it in its entirety.

A firm is all inflows and outflows, too.

This means you own all net cash flows that the firm earns, after adjusting for all your necessary investments.

$$\text{Entire Firm} = \text{All (Current and Future) Net Earnings}$$

Yet another way to look at the firm is to recognize that you will receive all the net cash flows that the firm will pay out (e.g., interest and dividends payments), adjusting, of course, for all the money that you may put into the firm in the future.

$$\text{Entire Firm} = \text{All (Current and Future Cash) Inflows} - \text{Outflows}$$

It follows immediately that all the payments satisfying stocks and liabilities must be equal to all the firm's net cash flows, which must be equal to the firm's net payouts. All of these equalities really just state the same thing: "Value adds up."

We emphasize stocks and bonds.

Our book will spend a lot of time discussing claims, and especially the debt and equity forms of financing—but for now, you can consider both debt and equity to be just simple investment projects: You put money in, and they pay money out. For many stock and bond investments that you can buy and sell in the financial markets, it is reasonable to assume that most investors enjoy very few, if any, non-cash-based benefits (such as emotional attachment).

### Investments and Corporate Finance

CorpFin = Supply.  
Investments = Demand.

So what is the difference between the two main introductory finance courses, one often called **Corporate Finance**, the other **Investments**? The first is primarily about the **supply** of assets to the financial markets. It is about firms who want to obtain funds from the financial markets and therefore issue claims. The second is primarily about the **demand** for assets by the financial markets. It is about investors who want to decide how to allocate their money across many potential opportunities. The two are not completely distinct: firms want to know what investors

like when they think about what claims they want to sell; and investors want to know what firms make good investments for their portfolios. Thus, the two courses have a fair amount of overlap. In the end, you will need to understand both sides. Corporate finance is a good start.

**Q 1.2.** In computing the cost of your M.B.A., should you take into account the loss of salary while going to school? Cite a few nonmonetary benefits that you reap as a student, too, and try to attach monetary value to them.

**Q 1.3.** If you buy a house and live in it, what are your inflows and outflows?

### 1.3 Firms versus Individuals

This book is primarily about teaching concepts that apply to firms. In particular, if you are reading this, your goal will be to learn how you should determine projects' values, given appropriate cash flows. What is your best tool? The law of one price, of course.

The same logic that applies to your Camry applies to corporate projects in the real world. Many have close comparables that make such relative valuation feasible. For example, say you want to put a value on building a new factory in Rhode Island. You have many alternatives: You could look at the values of similar existing or potential factories in Massachusetts. Or you could look at the values of similar factories in Mexico. Or you could look at how much it would cost just to buy the net output of the factory from another company. Or you could determine how much money you could earn if you invested your money instead in the bank or the stock market. If you understand how to estimate your factory's value *relative to your other opportunities*, you then know whether you should build it or not. But not all projects are easy to value in relative terms. For example, what would be the value of building a tunnel across the Atlantic, of controlling global warming, or of terraforming Mars to make it habitable for humans? There are no easy alternative objects to compare such projects to, so any valuation would inevitably be haphazard.

If a corporation can determine the value of projects, then it can determine whether it should take or pass on them. In the first part of this book, where we assume that the world is perfect (which will be explained in a moment), you will learn that projects have a unique value and firms should take all projects that add value (in an absolute sense). Later on, you will learn about a more realistic world in which projects can have values that are different for some owners than for others. In this case, you must take your specific situation into account when deciding whether you should take or leave projects.

An interesting aspect of corporate decision making is that the owners are often not the managers. Instead, the managers are hired professionals. For a publicly traded corporation that may have millions of shareholder owners, even the decision to hire managers is de facto no longer made by the owners, but by their representatives and other hired managers.

Unfortunately, it is just not feasible for managers simply to ask all the owners what they want. Therefore, one of the basic premises of finance is that owners expect their managers to maximize the value of the firm. You will learn that, in a perfect world, managers always know how to do this. However, in the world we live in, this can sometimes be difficult. How should a manager act if some owners dislike investing in cigarettes, yet others believe that the firm has great opportunities in selling green tea, yet others believe the firm should build warships, yet others believe the firm should just put all the money into the bank, and yet others believe the firm should return all their money to them? These are among the more intriguing problems that this book covers.

We use the same principles in corporate finance as in "home economics."

Relative valuation often works well in the corporate world.

Value in the corporate context can depend on the quality of the market.

Separation of ownership and management (control).

Managers should do what owners want—value maximization!

**Ethical dilemmas.**

The need for managers to decide on appropriate objectives also raises some interesting ethical concerns, most of which are beyond the scope of this book. But let me mention one anyway. As I just noted, the standard view is that corporations are set up to maximize the wealth of their owners. It is the government's job to create rules that constrain corporations to do so only within ethically appropriate boundaries. Thus, some will argue that it is the role of public institutions to pass laws that reduce the sale of products that kill (e.g., cigarettes), not the role of the corporation to abstain from selling them. If nothing else, they argue, if your corporation does not sell them, someone else almost surely will. (You can see this as a framework to help you understand corporations, not a normative opinion on what the moral obligations of companies should be. Nevertheless, it is also a view that many people have adopted as their normative perspective.) As if selling harmful products were not a complex enough dilemma, consider that laws are often passed by legislators who receive donations from tobacco corporations. (Indeed, public institutions are intentionally set up to facilitate such two-way "communications.") What are the moral obligations of tobacco firm owners, their corporations, and their managers now? Fortunately, you first need to learn about value maximization before you are ready to move on to these tougher questions. For the most part, this book sticks with the view that value maximization is the corporation's main objective. This is not to endorse it, but to contemplate what to do if it is so.

**Let's get rolling.**

Let's begin looking at how you should estimate project value.

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**Q 1.4.** Can you use the "law of one price" in your decision of whether to take or reject projects?

**Q 1.5.** What is the main objective of corporate managers that this book assumes?

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### Keywords

Bond, 4. Cash flow, 3. Claim, 4. Corporate Finance, 4. Cost, 3. Debt, 4. Demand, 4. Equity, 4. Expense, 3. Firm, 4. Investment, 3. Investments, 4. Law of one price, 2. Payoff, 3. Project, 3. Return, 3. Revenue, 3. Stock, 4. Supply, 4. Valuation, 1.

### Answers

**Q 1.1** Here are my own judgment calls.

1. Easy. There are many foreign currency transactions, so you can easily figure out how many U.S. dollars you can get for 10,000 euros. You can find this exchange rate on many web sites, e.g., [YAHOO! FINANCE \(http://finance.yahoo.com\)](http://finance.yahoo.com).
2. Depends. Some paintings are easier to value than others. For example, Warhol painted similar works repeatedly, and the price of one may be a good indication for the price of others. For other paintings, this can be very hard. What is the value of the *Mona Lisa*, for example? There are other da Vincis that may help, but ultimately, the *Mona Lisa* is unique.
3. The Washington Monument is more than just the value of its

closest alternative—which would be rebuilding it elsewhere. This may or may not be easy.

4. Many individual buildings in Manhattan have sold, so you have good comparables for the individual components (buildings). However, no one has attempted to buy an entire world center like Manhattan, which means that it may be difficult to estimate it accurately.
5. The Chrysler Building would be relatively easy to value. There are many similar buildings that have changed hands in the last few years.
6. A lower bound is easy, because we know how much candidates tend to spend to win election. However, the cost varies with the candidate and locale.

7. Foreign stamps are harder to value than foreign currency, but probably not that much harder. Stamp collectors know and usually publish the prices at which the same stamps have traded in the past years.
8. Love—oh, dear.
9. Valuing yourself is a tough issue. You can look at yourself as a collection of cash flows, similar to other “walking cash flows,” but doing so is highly error-prone. Nevertheless, having no other opportunities, this is how insurance companies attach a value to life in court. You may consider yourself more unique and irreplaceable. Still, you can infer your own value for your life by figuring out how willing you are to take the risk of losing it—e.g., by crossing the street, snowboarding, or motorcycling. I have also read that doctors work out what the value of all the proteins in your body are, which comes out to be many million dollars. Physicists, on the other hand, break down the proteins further and come up with an estimate that is less than a dollar.
10. This is a very difficult task. We know that governments have

spent a great amount of cash trying to preserve the environment in order to help species. The Yangtze river dolphin, however, just recently became extinct, primarily due to human activity. What is the value of this loss? Unfortunately, we don't have good comparables.

**Q 1.2** Definitely yes. Foregone salary is a cost that you are bearing. This can be reasonably estimated, and many economic consulting firms regularly do so. As to (partly) nonmonetary benefits, there is the reputation that the degree bestows on you, the education that betters you, and the pleasure that excessive beer consumption gives you (if applicable).

**Q 1.3** Inflows: Value of implicit rent. Capital gain if house appreciates. Outflows: Maintenance costs. Transaction costs. Mortgage costs. Real estate tax. Uninsured potential losses. Capital loss if house depreciates. And so on.

**Q 1.4** Often, absolutely yes. Indeed, the law of one price is the foundation upon which all project choice is based.

**Q 1.5** Maximizing the value of the firm.

### End of Chapter Problems

**Q 1.6.** What is the law of one price?

**Q 1.7.** What is the difference between investing in the stock and investing in the bond of a corporation? Which one is the less risky investment and why?

**Q 1.8.** What is the difference between the value of the firm and the sum of the values of all outstanding obligations and all outstanding stocks?

**Q 1.9.** A degree program costs \$50,000 in total expenses: \$30,000 in tuition and \$20,000 in housing and books. The U.S. government provides a \$10,000 grant for the tuition. Moreover, the university pays \$20,000 of the \$30,000 tuition in salary to your instructors. Because being in the program is so much fun, you would be willing to pay a net of \$5,000 for the pleasure, relative to your alternatives. What is the net cost of the education to you?



### Data and Programming for Masters Students

**Task:** Write a python or perl program that scrapes characteristics data on Camries and Accords for sale (year, mileage, location, color, condition, options, prices) from websites. Write an R program that presents the data visually. Discuss how well the law-of-one-price seems to hold.

