Part 6. Valuation

One of the most basic questions in finance is valuation: What is something worth? This problem comes up in a number of different settings, for example you could be:

- Buying a house
- Buying an apartment building as an investment
- Buying a company
- Buying a bond
- Buying stock in a company.

Even though the assets are quite different, the theory underlying how you go about valuing these assets is the same.

This section is designed to give you just an overview of the valuation process; actual valuation can be a very complicated activity. Often valuation is done by a specialist such as a real estate appraiser, small business consultant, or an investment bank. It is also worth mentioning that valuation is an inexact process, and as we will see, there is more than one way to value an asset. Often it is useful to value an asset using more than one method to see if they give you the same answer.

There are several different approaches to valuation:

Use the price of a similar item:

Whenever you borrow money to buy a house, part of the home-buying process is to have an appraiser determine what they think the house is worth. The lender wants to do this to be sure they are not lending you $200,000 to buy a house that is only worth $150,000. The standard approach to appraising a house is to compare it to similar houses in the neighborhood that have recently sold. If the house next door just sold for $250,000 then you might think that your house is worth $250,000 too. Of course, this is only the starting figure, you might have to make adjustments if one house has an extra bedroom or the other house has a larger lot. But all of these are factors that can be incorporated into the appraised value.

The strength of this approach is that it is easy to do, and it does make a lot of sense. The market price of an asset tells you the value that other people put on the asset. In fact, this approach is behind the way we value many financial assets. Say that you own 100 shares of General Motors stock. What is the value of those shares? You would look at the price they sell for in the market. How did the market come up with that value? We will examine that question in a moment.

Of course, there are some weaknesses to this approach too. There may not be any similar houses in the same neighborhood, so you may have to use different houses in other neighborhoods, and this will make your estimate of the value less accurate. This can be a big problem when determining the value of a large company; there may simply not be any companies that look the same. You will need to use another method to determine the value.

A separate problem is that this is determining the value of the asset to the *market*, not the value to *you*. Maybe the house is worth $250,000 to other people in the market, but you like its view so much that you would be willing to pay substantially more. The house is certainly more valuable

to you than $250,000. However, that is not the point of the appraisal. The bank wants to make sure that if you default on the loan, that they can sell the house to get their money back. It doesn't matter to the bank how much you like the house, what matter is what they can sell it for. This is an important point. We are not trying to determine what something is "worth" in the greater sense of things. We want to know the value of something as it relates to a particular financial question, in this case, what is the house worth if we had to sell it.

A third problem with this approach is it tells you what the asset is worth now, but not what it will be worth in the future. Prices of assets can go up or down and the risk of that may affect your decision to buy the asset. Of course, the market price of an asset includes an adjustment for risk, but the valuation process doesn't tell you anything specific about the kinds of risk you might face.

Use the balance sheet to determine value

If we are valuing a company, we can get some information from its balance sheet. The accounting value of a company is the book value of its equity, which equals the difference between its total assets and its liabilities. For example, a company with a building worth $500,000 on its balance sheet and an outstanding debt of $300,000 would be worth $200,000. This is called the book value since the values are calculated from the balance sheet. A weakness of this approach is that these values may no longer be accurate. The building might now be worth $800,000 as property values have increased. An improvement over book value would be to value the assets and liabilities at their market prices. This can be more difficult to do but will provide a more accurate notion of the value of the company. A variation on this approach is to determine the liquidation value of the company; how much you would get if you had to shut down the business and sell off the assets. This is a conservative valuation of the business and takes a worse case approach. It is what you would get if things went bad and you did not have the time to make a more deliberate sale.

Use earnings multiples to determine value

Sometimes the value of a company is not well captured by the assets on its balance sheet. For example, you might own a small accounting company that handles individual taxes reports and small company taxes and financial statements. If you rent your office space you may have very little in tangible assets but you could still generate a lot of earnings. The value of the company is really in the value of the relationships that you have with your customers, which is hard to measure. The company is better described by the earnings it generates rather than the assets it has.

But how do you go from the earnings generated in a single year to the value of the company? A common approach to this kind of valuation problem is to use an earnings multiple. That is, a formula that says that a company is worth some multiple of its earnings (or its sales or its revenue). For example, in a certain industry it might be standard that a company is worth 10 times its earnings.

If there are standard multiples available, this is a quick and easy approach to take. But there can be some complications. Sometimes it is difficult to get reliable measures of earnings from financial statements. Also, where does the multiple come from, and does it make sense for you? And what happens if there is no standard multiple?

Use discounted cash flow to determine value

An alternate approach is to recognize that the value of many assets, particularly those made as investments, is the cash that the asset generates. An apartment building is worth the cash that it generates from rents. A bond is worth the cash it generates from coupon and face-value payments. A business is worth the cash it generates from its activities. The value of the asset is fundamentally equal to the present value of all the cash flows. This is the best approach to valuation in terms of accuracy, but has some practical difficulties. It can be very hard to come up with reliable estimates of future cash flows. Also, for individuals who are inexperience with financial analysis the process of discounting future cash flows can be difficult (although that shouldn't be a problem for us). Because of these difficulties, individuals will often use other approaches to valuation.

We know from the previous section how to discount cash flows. So, anything we can describe as a stream of cash flows we can value. This valuation process has three steps.

> **1) Determine the cash flows**. This is the hard part. In some cases, as with bonds, we will be told what the cash flows are. But in most cases, as with commercial real estate investments or with businesses, figuring out the cash flows takes a detailed knowledge of the business.   It is not simply a finance task; it is a business task.

> **2) Determine the appropriate discount rate.** Just as in the last section, we need to determine the appropriate interest rate to discount the future cash flows. At this point we won't add much to what we know, but later, in the sections on risk and return and corporate finance, we will return to this issue.

> **3) Determine the value of the cash flows.** This is the easy part. Once we have the cash flows and the interest rate, it is straightforward to calculate the present value.

For the remainder of this section, we shall see how discounted cash flow analysis can be used to value a number of different assets, including bonds, stock and companies.

Applications to Bond Pricing

Bonds are a way for a company to raise money. A company sells a bond, which is just a promise to make regular payments over some period of time.

Why do you need to know how bond prices are determined? First, this is a good place to start learning the discounted cash flow technique since bonds are a particularly clear-cut example. Also, the connection between bond prices and interest rates is an important thing to know when making investments.

Bonds are bought and sold in the open market. To determine what the price of a bond is, we need to know the value of the cash flows.

Step 1 is to determine the cash flow from the bond. Payments from a bond take two forms. The **par**, or **face value** of the bond, is the amount that the firm intends to raise from the bond. This is equivalent to the principal of the loan and is paid to the investor at the end of the life of the bond. Bonds are often referred to by their maturity: the time from the present, or when the bond was issued, until the face value is paid. Bonds also make interest payments. The way they do this is through coupon payments, which are just fixed payments made at regular intervals, usually twice

per year. The coupon payment is often measured by the coupon rate, which is the annual payment as a fraction of the par value.

> **Example**: GM issues a 10-year bond with par value of $1,000 and semi-annual coupon payments at a coupon rate of 5%. What is the timing of all the payments?
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> When GM first sells the bond it receives $1,000 from the purchaser. GM then makes coupon payments of $25 twice a year (5% of $1,000 is $50 per year or $25 per half year). At the end of 10 years, GM pays the par value of $1,000 to whoever owns the bond.

It should be noted, that unlike mortgages, bonds are non-amortizing loans. GM does not pay down the loan as it goes, rather it pays interest in order to defer paying the principal, and then pays the principal off in entirety when the bond matures.

Now, if we knew the appropriate interest rate to discount the future payments, we would know what this bond is worth to us. This is a present value problem; the only complication is that there are really two kinds of payments, the coupon payments which are an annuity, and the face value, which is a single future payment. The value to you of the bond is the sum of the two payments. Most financial calculators can simplify this by taking both bits of information at the same time.

> **Example:** GM issues a 10-year bond with par value of $1,000 and semi-annual coupon payments at a coupon rate of 5%. At an interest rate of 7%, what is the value of the bond?
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> Again the cash flows are $25 semi-annually for 10 years with $1,000 at the end of 10 years. The $1,000 is the future value; this tells the calculator that we have two cash flows, an annuity and a final payment. We convert everything to a semi-annual basis and then input:
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> > $N = 20$
> > $I/Y = 3.5$
> > $PV = ?$
> > $PMT = 25$
> > $FV = 1,000$
>
> The present value of the bond is then $858 (the calculator will give this as a negative value, since it is a payment out).

From the way the bond is constructed, if we discounted the bond at the coupon rate (5% in the last example) the value of the bond to us would just equal its price. Try it.

This present value determines what the bond is worth to *you*. However, the price of the bond is determined in the market, depending on the supply and demand for the bond. The equilibrium interest rate offered by the bond is called the **yield to maturity** and is the interest rate that equates the present value of the payments of the bond with the price of the bond.

> **Example**: A 20-year bond with a 4% coupon rate paid semi-annually and a face value of $1,000 sells for $1,100. What is the yield to maturity on this bond?

$$N = 40$$
$$I/Y = ?$$
$$PV = -1,100$$
$$PMT= 20$$
$$FV = 1,000$$

The answer is I/Y=1.66 to give an annual yield to maturity of 3.32.

It is important to realize that the yield to maturity on a bond does not have to equal its coupon rate. The coupon rate is basically set to equal the yield to maturity in the market at the time the bond was *issued*. However, the issuer is obligated to pay the dollar amount implied by the coupon rate for the lifetime of the bond. If interest rates in the market change, this will be reflected as changes in the price of the bond.

The Connection between Interest Rates and Bond Prices

Bond prices and yields are two different ways of expressing the value of a bond. Once we know the price of a bond we can determine its yield, or if we know the yield we can determine the price. We will refer to bonds by prices or yields depending on which is the most convenient.

The important fact to remember is that bond prices and yields vary inversely. If the bond price increases, and the payments stay constant, it means that the yield will be lower. If the bond price decreases, then the yield will be higher. Because of this, when it is reported that bond prices are falling, we also know that interest rates (bond yields) are increasing.

Risk and bond prices

Up to this point, we have not discussed how risk affects bond prices. The best way to think about this is by using our "components" approach to interest rates (which we developed in the section on financial markets). Bonds face different kinds of risk, and investors need to be compensated for each type of risk by getting a greater yield.

> **Default risk**: This reflects the probability that the company will not be able to make the coupon or face value payments. Companies that are more likely to default will have a higher interest rate/yield on their bonds.

> **Price risk:** (sometimes also called interest rate risk or maturity risk) This is the risk that the value of the bond will change in the future. Say that you buy a 5-year bond that you intend to sell in two years. If interest rates increase in those two years, the price of bond will fall, and you will be worse off (or if interest rates fall, you will be better off). Since there is some uncertainty about the return, investors must be compensated for holding this risk.

> The degree of this risk depends on the maturity of the bond, which is why it is sometimes called maturity risk. The longer the maturity of the bond, the more risk there will be, since the values of payments far in the future are very sensitive to changes in interest rates.

Valuing Preferred Stock

Preferred stock is a special type of security that is halfway between bonds and stock. Preferred stock offers a fixed dividend, as long as the company pays a dividend. Ignoring risk (which we will cover later), we can think of preferred stock as an infinite stream of dividends, in other words, a perpetuity. Letting D stand for dividends, the value of preferred stock is the present value of the dividend payments. Our formula for the value of a perpetuity gives us,

Value of Preferred Stock = D/k

Given the value of dividends and the discount rate we can determine the value of the preferred stock.

> **Example:** Preferred stock for Eastern Digital pays dividends of $5 per quarter. We discount future payments at 10%. What is the value of this stock?

> First, we recognize that dividends are paid quarterly so we need to adjust our discount rate appropriately. Using our perpetuity formula, the value of preferred stock = 5/0.025 = $200.

Of course, this is an approximation since the company will not go on forever, but we know from our discussion of perpetuities that it will be a good approximation for a long-lived company.

Valuing Common Stock

Now let's use our discounted cash flow technique on common stock. Common stock differs from preferred stock in that the dividends that the stock pays are not fixed. But we will start with the assumption that we can expect certain dividends and take it from there.

In this case, we end up with the same case as preferred stock. The value of the stock is the discounted value of the future dividends. If the dividends are fixed at an amount D, then the value of the stock is given by our perpetuity formula D/k.

What if dividends are growing over time?

It is common that the dividends will grow over time, as the activities of the company expand. If the dividends grow over time at a constant rate, we can use a slightly modified version of our perpetuity formula. The value of stock that pays dividends of D_1 starting next year, with a growth rate of dividends of *g*, at an interest rate of *k* is given by,

Value = $D_1/(k\text{-}g)$

Since the dividends are different every period, we need to specify which dividend payment we are using in our formula. These formulas assume that the payments start at the end of the first period.

> **Example**: The earnings of Eastern Digital are expected to grow at 3% per year into the indefinite future. The next dividend payment will be $4 per share. The rate of return on similar stocks is 8%. What should the price of Eastern Digital stock be?
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> The price is given by 4/(0.08-0.03) = 4/0.05 = $80

Notice that k and g have opposite effects. k reduces the value of stock, as it implies that money paid in the future is worth less. g increases the value of stock, as a faster growth rate means that more money will be paid in the future. This approach to stock pricing is sometimes called the Gordon model after the developer, Myron Gordon.

What if the company does not pay dividends?

Some companies do not pay any dividends; can we still use this approach? This is still a valid approach as long as the company *could* pay dividends. Owning stock means that you are part owner of the company. Income earned by the company could be given back to you in dividends, or it could be invested by the company in new projects that will yield future profits. As long as the company is profitable, it doesn't matter if they pay dividends now or not (there are a few qualifications to this point; we will return to this issue in a later section).

If we don't have dividends we need to use other measures of profitability. We could use cash flow, but more commonly, earnings are used as the measure of profits. Letting E stand for earnings, we can use our perpetuity formula again to value stock:

Value = E/k

Why does it matter what we think shares are worth? Can't we just determine the value from the market? We will talk about this more later in the class, but one approach to investing argues that sometimes the market gets the price of stock wrong and so we should buy stock that we believe is worth more than the market price and sell stock that is worth less.

> **Example:** We look at a company and its business strategy and estimate that it can generate cash flow of $20 million per year, growing at 1% per year. The appropriate interest rate to discount this cash flow is 7%. There are 10 million shares outstanding. The shares are selling for $25 per share. Should we buy shares in this company?
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> Using our valuation formula (Gordon growth model) the value of the company is given by 20/(0.07-0.01), which equals $333m. The value of one share of the company is $33, which is greater than the current price. This suggests that the company is undervalued and we should buy shares.

Questions about the growth rate assumption

What should we do if the dividend payments are not constant, or if the growth rate is expected to change over time? There are versions of the Gordon growth model that assume more complicated payment patterns, although if the payment patterns get too complicated, the benefits of using these formulas are less. The next section looks at how to handle some of these issues.

One use of this formula is a check on the reasonableness of the price of stock. Say that we know the price of the stock and the current dividend payments. We can then determine values of

discount rates and dividend growth rates that make sense for this stock. That is, the values such that it would be worthwhile for us to buy the stock.

> **Example**: We know that the price of a share in a company is $50 and its dividend is $1. Given the dividend, is it reasonable for the share to sell for $50?
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> Using our formula we have,
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> $$\$50 = 1/(k\text{-}g)$$
>
> so that k-g = 0.02. This ties together the growth rate assumption and our discount rate. If we think that a reasonable discount rate is 14%, then earnings must grow at 12% per year. If we believe that this growth rate cannot be achieved, then the stock price is overvalued. On the other hand, if we think that a discount rate of 8% appropriate, then dividends only need to grow at 6% per year for the stock to be fairly valued.

What if the future cash flows are uncertain?

So far we have been assuming that the dividends or cash flow from the company is known for certain. In practice, this is almost never the case. Cash flows that are more uncertain should be discounted at a higher rate.

Using price/earnings ratios to value stock

The price/earnings (P/E) approach to valuing stock uses two different valuation concepts: valuing an asset using an earnings multiple, and valuing an asset by comparing it to similar assets. The P/E ratio is the ratio of the price of a share to the company's earnings per share. This tells you how expensive it is to buy a given amount of earnings (which is why it is sometimes referred to as an earnings multiple: if the P/E ratio is 20, it takes $20 to buy a dollar's worth of earnings paid this year and into the future). It should take the same amount of money to buy a dollar's worth of earnings of any company, everything else being equal. The P/E ratio is closely tied to the Gordon growth model. As an exercise, can you show how they are related?

> **Example:** Assume that companies in the auto parts manufacturing industry sell with P/E ratios of 15. (Each dollar of earnings per share is worth 15 dollars to the price). Jim's Steering Wheels, Inc. has earnings of $3 per share and is currently selling for $60 per share. At typical industry multiples (that is, a P/E ratio of 15) the stock should sell for $45. At its current price it is too expensive and we should not buy it. Of course, this conclusion depends on whether a 15 P/E ratio is really correct for Jim's Steering Wheels. Maybe this company has better growth prospects or lower risk. The usefulness of the P/E ratio approach to valuing stock depends on knowing what the correct P/E ratio should be.

Our first approach to valuating stock (the discounted value of all the cash flows) was very detailed; it required us to collect extensive data about the company. All this information will help us make a good estimate of the value of the company but may be very costly to get. The second method (the P/E ratio) doesn't take much information, but it also runs a real risk of oversimplifying things. Most financial analysis tends to lie between these two extremes. The analyst will both look at the business prospects of the company, and see if any key financial ratios stand out, including the P/E ratio. Based on their overall impression of the business, they will determine what they think the business is worth and compare that with the market price.

Valuing a Company

Valuing a company is just like valuing stock; after all, the total value of all the stock of a company should equal the value of the company as a whole. However, in some cases, the cash flows of a company will be very uneven making the Gordon growth model or P/E ratio approach hard to apply. In this situation, we need to calculate the present value of each of the cash payments directly.

For example, you want to value a small retail concern. You have collected information on the operations of the business and its prospects and you have come up with estimates of the net cash flows. At the start, cash flows are uneven, reflecting capital purchases, other costs of getting the business going, and the time it takes to build up sales. After about five years, you expect the business to settle down to a regular cash flow.

Year	Net Cash Flow
1	-10
2	2
3	4
4	4
5	6
6	7
7	7
8	7

We can determine the value of the company in two stages. The value of the first five years is determined by taking the present value of the each of the individual cash payments. From year 6 on, the payments are regular, in part because the business has settled down, and in part because we do not have enough information to justify any changes to these values. We can imagine determining the value of the company in year five given the future cash flow. We call this a **terminal value**. (Sometimes "terminal value" is used to mean the last value, as in this case. Other times, it refers to the value when the asset is sold). The value of the company consists of the present value of the cash flows in the near future plus the terminal value. In this case, the terminal value is give by a perpetuity. If we use a 10% discount rate, we have the following present values

Year	Net Cash Flow
1	-9.09
2	1.65
3	3.01
4	2.73
5	3.73
+ the terminal value	

To find the terminal value, we look at the value of a perpetuity paying 7 each period, which equals $7/0.1 = 70$. However, this is the value of the perpetuity in period 5. We need to calculate the present value, which equals 43.46. As is often the case, the terminal value of the company plays a very large part in determining its value. Adding everything together we get $45.49.

This value depends critically on our estimates of the cash flow and what discount rate we use. Since we often do not have perfect information about these variables, a thorough valuation will take into account the uncertainty about our forecasts. A later section will introduce some techniques for incorporating uncertainty into our calculation.