1. Introduction

Valuation compares the benefits of a future investment decision with its cost. The process of valuation involves estimating future cash flows -- both inflows and outflows -- and discounting these future cash flows to the present at a discount rate that reflects the uncertainty of these cash flows. Another way of evaluating investments is to answer the question: given its cost and its expected future benefits, what return will a particular investment provide? We will look at how to calculate the value and the return on investments, focusing stocks in this reading.

Suppose I offer you the following investment opportunity: give me $900 today, and I will pay you $1,000 one year from today. Whether or not this is a good investment depends on:

• What you could have done with your $900 instead of investing it with me, and
• How uncertain are you that I will pay the $1,000 in one year.

If your other opportunities with the same amount of uncertainty provide a return of 10 percent, is this loan a good investment? There are two ways to evaluate this. First, you can figure out what you could have wound up with after one year, investing your $900 at 10 percent:

- Value at end of one year = $900 + (10% of $900)
- Value at end of one year = $900 (1 + 0.10)
- Value at end of one year = $990.

Since the $1,000 promised is more than $990, you are better off with the investment I am offering you.

Another way of looking at this is to figure out what the $1,000 promised in the future is worth today. To calculate its present value, we must discount the $1,000 at some rate. The rate we'll use is our opportunity cost of funds, which in this case is 10 percent:

\[
\text{Value today of } \$1,000 \text{ in one year} = \frac{\$1,000}{(1 + 0.10)} = \$909.09
\]

This means that you consider $909.09 today to be worth the same as $1,000 in one year. In other words, if you invested $909.09 today in an investment that yields 10 percent, you end up with $1,000 in one year. Since today's value of the receipt of $1,000 in the future is $909.09 and it only
costs $900 to get into this deal, the investment is attractive: it costs less than what you have
determined it is worth.

Because there are two ways to look at this -- through its future value or through its present value --
which way should you go? While both approaches get you to the same decision, it is usually easier in
terms of the present value of the investment.

Let's look at another example. Suppose you have an opportunity to buy an asset expected to give
you $500 in one year and $600 in two years. If your other investment opportunities with the same
amount of risk give you a return of 5 percent a year, how much are you willing to pay today to get
these two future receipts?

We can figure this out by discounting the $500 one period at 5 percent and the second $600 two
periods at 5 percent:

\[
\text{Present value of investment} = \frac{\$500}{(1 + 0.05)^1} + \frac{\$600}{(1 + 0.05)^2}
\]

\[
\text{Present value of investment} = \$476.19 + \$544.22
\]

\[
\text{Present value of investment} = \$1,020.41
\]

Using a financial calculator's NPV function, we can arrive at the same present value.

This investment is worth $1,020.41 today, so you will be willing to pay $1,020.41 or less for this
investment:

- If you pay more than $1,020.41, you get a return less than 5 percent;
- If you pay less than $1,020.41 you get a return more than 5 percent; and
- If you pay $1,020.41 you get a return of 5 percent.

We can look at this problem from a different perspective, solving for the return on the investment.
Suppose you pay $1,000 for the investment that produces $500 at the end of one period and $600 at
the end of two periods. What is the return on this investment? Solving for the return involves trial
and error -- that is, trying different interest rates to find the one in which the cost of the investment
(the $1,000) is equal to the present value of the two cash flows.

Try 4 percent

\[
\$1,000 = \frac{\$500}{(1 + 0.04)^1} + \frac{\$600}{(1 + 0.04)^2}
\]

\[
\$1,000 = \$480.77 + \$554.73
\]

\[
\$1,000 \neq \$1,035.50
\]

This tells us that we have not discounted enough (that is, 4 percent is too low a rate). We know that
the present value of these cash flows using a 5 percent discount rate is $1,020.41 (from our work
above), so we should try an even higher rate of 6 percent:

Try 6 percent

\[
\$1,000 = \frac{\$500}{(1 + 0.06)^1} + \frac{\$600}{(1 + 0.06)^2}
\]

\[
\$1,000 = \$471.70 + \$534.00
\]

\[
\$1,000 \neq \$1,005.70
\]
Repeating this same procedure using 7 percent gives us a value of the right-hand side of this equation of $991.35. Because $991.35 is less than the $1,000, this means that the rate that equates the cost of the investment (the $1,000) with the future cash flows is between 6 percent and 7 percent. Using a financial calculator’s IRR function, we can determine this precisely – and without having to do all the iterations ourselves.

The interest rate that equates the $1,000 investment with the present value of the two cash flows is 6.39 percent. This means that if you buy this investment for $1,000 and hold it for two years and receive the $500 and $600 as promised, you will have a return of 6.39 percent on your investment. This interest rate is often referred to as the investment’s internal rate of return (IRR).

Let’s look at still another example. Suppose you are evaluating an investment that promises $10 every year forever. This type of cash flow stream is referred to as a perpetuity. The value of this investment is the present value of the stream of $10’s to be received each year to infinity where each $10 is discounted the appropriate number of periods at some annual rate i:

$$\text{Present value of investment} = \frac{\$10}{(1+i)^1} + \frac{\$10}{(1+i)^2} + \frac{\$10}{(1+i)^3} + \ldots + \frac{\$10}{(1+i)^\infty}$$

which we can write in short-hand notation using summation notation as:

$$\text{Present value of investment} = \sum_{t=1}^{\infty} \frac{\$10}{(1+i)^t} = \$10 \sum_{t=1}^{\infty} \frac{1}{(1+i)^t}$$

Or, because as t approaches infinity, $1/(1 + i)^t$ is equal to $1/i$, we can rewrite the present value of this perpetual stream as:

$$\text{Present value of investment} = \$10 \left( \frac{1}{i} \right) = \frac{\$10}{i}$$

If the discount rate to translate this future stream into a present value is 10 percent, the value of the investment is $100:

$$\text{Present value of investment} = \frac{\$10}{0.10} = $100.$$
flows for a finite number of periods, \( N \), and the discount rate is \( i \), the value of the investment -- the present value -- is:

\[
\text{Present value of investment} = \sum_{t=1}^{N} \frac{CF_t}{(1+i)^t}
\]

which we can write more compactly as:

\[
\text{Present value of the investment} = \sum_{t=1}^{N} \frac{CF_t}{(1+i)^t}
\]

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### Example 1: Value of an investment

**Problem**

What is the value of an investment that provides cash flows of $2,000 at the end of each year for the next four years if you have determined that the appropriate discount rate on this investment is 6 percent?

**Solution**

Because these cash flows are the same amount and occur at regular intervals of time, we can solve this using an ordinary annuity approach:

- PMT = $2,000
- \( N = 4 \)
- \( i = 6\% \)
- \( PV = \$6,930.21 \)

### Example 2: Value of an investment with uneven cash flows

**Problem**

Consider the following cash inflows from an investment today:

<table>
<thead>
<tr>
<th>Years from today</th>
<th>End of period cash flow</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$3,000</td>
</tr>
<tr>
<td>2</td>
<td>$0</td>
</tr>
<tr>
<td>3</td>
<td>$2,500</td>
</tr>
</tbody>
</table>

If your opportunity cost of funds is 5 percent, what is this investment worth today?

**Solution**

Given:

- \( CF_1 = $3,000 \)
- \( CF_2 = $0 \)
- \( CF_3 = $2,500 \)
- \( i = 5\% \)

- \( PV = \$5,016.7369 \)

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2. **The Role of the Marketplace in the Valuation of Assets**

"Both wise mean and foolish will trade in the market, but no one group by itself will set the price. Nor will it matter what the majority, however overwhelming, may think; for the last owner, and he alone, will set the price. Thus marginal opinion will determine market price."


If you are faced with a decision whether to make a particular investment, you figure out what it is worth to you -- its value -- and compare it with what it will cost you. If the investment costs less than you think it is worth, you will buy it; if it costs more than you think it is worth, you will not buy it.

Now suppose several different people are considering buying the same, one of a kind asset. Each potential investor evaluates whether the asset is priced at more or less than what he or she thinks it
is worth by making this comparison and either buying or selling the asset based on whether they think it is over- or under-priced, the buyers and sellers determine its price.

A. Price determination in a market

Let's see how this works. Three investors, A, B, and C, have an opportunity to buy an asset expected to generate $100 each period forever. This is a perpetuity whose value is the ratio of the $100 to the discount rate.

If each investor thinks that this asset represents an investment that has a different amount of risk, they each will use a different discount rate to value it. If investors are risk averse -- they do not like risk -- they will value an asset using a higher discount rate the more uncertain they are about the future cash flows. Suppose:

<table>
<thead>
<tr>
<th>Investor</th>
<th>Discount Rate</th>
<th>Asset Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>8.0%</td>
<td>$1,250</td>
</tr>
<tr>
<td>B</td>
<td>10.0%</td>
<td>$1,000</td>
</tr>
<tr>
<td>C</td>
<td>12.5%</td>
<td>$800</td>
</tr>
</tbody>
</table>

And suppose the asset is owned by Investor C who has been looking at alternative investment opportunities with similar risk that yield 12.5 percent and as a result figures that the asset is worth only $800. Both Investors A and B would be interested in buying it from C for more than $800 and C would be willing to sell it for more than $800. Since both A and B want this asset, they would bid for it.

So what is the market price of the asset? If its price is $1,000, Investor B would be indifferent between this asset and his other investments of similar risk. At $1,000, Investor A would still think it is under-priced and want to buy it. So the price is bid up to reflect the highest value investors are willing to pay: $1,250. If Investor A buys the asset for $1,250, he gets a return of 8 percent, which is what he thinks is appropriate given his assessment of the asset's risk.

What makes this process work is investors' desire to exploit profitable opportunities: C to sell it for more than she thinks it is worth, and A and B to buy it for less than they think it is worth.

If we assume that investors are interested in maximizing their wealth, those investors thinking an asset is over-priced will want to sell it and those thinking it is under-priced will want to buy it. Buyers and sellers will continue to buy and sell until they have exhausted what they believe are all the profitable opportunities. When that happens, the assets are neither over- nor under-priced. This point where buying and selling is in balance is referred to as a market equilibrium. As John Burr William states, the price of an asset is determined by the investor with the highest valuation of the asset. If the price of an asset is above or below its market equilibrium price, investors will buy and sell it until its price is the market equilibrium price. As long as an asset can be traded without any restrictions in a market, buying and selling it will determine its price. However, if there is a barrier to trading -- such as a limit on the quantity that can be sold -- this trading is inhibited and the asset's price will not reflect the valuation of the highest valuer.

In addition, if there are costs to trading -- such as a fee each time a trade is made -- investors will figure the cost into their bidding. For example, if there is a $100 fee to buy the asset, the most Investor A would be willing to pay is $1,150 and the most Investor B would be willing to pay is $900, considering there is a $100 fee to buy it.

B. Markets

A market may be structured as a pure auction market, as a dealer market, as a call market, or some combination of these markets. In a pure auction market buyers and sellers submit bids to a central
location. These buy and sell orders are matched by a broker. In a **dealer market**, the dealers -- who are individuals -- own securities. They stand ready to buy or sell securities and will quote a bid and an ask price. Brokers, who represent investors who wish to buy or sell, then shop around for dealer with best price.

In a **call market** the trading of individual stocks takes place at specified times. One party determines the single price that satisfies the most orders and then all transactions at this price. In a continuous market, trades occur whenever the market is open and the prices are determined by auction or by dealers. In the New York Stock Exchange (NYSE), for example, the opening price is determined by a call market, but then trading during the trading hours is determined by the continuous market.

The NYSE is the largest stock exchange in the U.S. in terms of the market value of shares traded, whereas the Chicago Board Options Exchange (CBOE) is the largest options exchange. National exchanges outside the U.S. include the London Stock Exchange (LSE) and the Tokyo Stock Exchange (TSE).

The Nasdaq is a large U.S. over-the-counter market. An **over-the-counter market** has no physical presence, but rather trading is carried out over computers. The Nasdaq was created in 1971 by the National Association of Securities Dealers (NASD) to become the first electronic market in the U.S. However, the Nasdaq is currently exploring a conversion to an exchange. The Nasdaq has two markets: the **National Market System**, which are the larger, more actively traded securities, and SmallCap, which are the smaller, newer companies.

One of the distinguishing differences between the NYSE and Nasdaq markets is the listing standards. For example, the NYSE requires that the company be much larger in terms of market value of equity, net income, and share trading volume that is required by the Nasdaq market.

Another difference between the markets is the procedure for trading. The NYSE is an **auction market**, whereas the Nasdaq is a **dealer market**. In the Nasdaq, investors buy from and sell to a dealer; in the NYSE, on the other hand, investors are buying and selling between each other, with bidding among investors. In the Nasdaq market, market makers, who are the dealers, manage the process by working with investors; in the NYSE market, the specialist manages the process by matching buyers and sellers.

The markets in the U.S. for stocks, bonds, and options are well-organized, self-regulated, and efficient. Therefore we can have confidence that the prices we observe for these assets reflect their true value to investors.

### 3. Valuation of securities

When we value an investment, we need to know its expected future cash flows and the uncertainty of receiving them. To value securities you must understand the nature of the cash flows, their timing, and the uncertainty associated with these future cash flows. Let's look at three types of securities: common stock, preferred stock, and debt. These securities have different types of cash flows and the uncertainty of each is different also.

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1. Note that the Nasdaq is not an exchange. Though it has applied to become an exchange, it is not one yet.
Notes and bonds are both debt securities. Both are legal contracts to pay interest and principal. The primary difference between a note and a bond is that a bond has an indenture agreement, which is a document stating the certain conditions and restrictions that the borrower must satisfy, such as maintaining a specified current ratio.

Most debt securities represent obligations of the borrower to pay interest at regular intervals (usually every six months) and to repay the principal amount of the loan -- referred to as the maturity value or the face value -- at the end of the loan period; that is, at maturity. If you issue a debt security, you are entering into a contract with the purchaser of that debt security -- the creditor -- to repay the loan. Any interest and principal that you promise to pay are legal obligations -- failure to pay as promised results in dire consequences.

Debt securities are senior to equity securities: the borrower must satisfy their obligations to the creditors before making payments to owners. Therefore, the cash flows from debt securities are more certain than the cash flows of either preferred stock or common stock.

If you invest in common stock, you buy shares that represent an ownership interest in the firm. Shares of common stock are a perpetual security -- there is no maturity. If you own shares of common stock, you have the right to receive a certain portion of any dividends -- but dividends are not a sure thing. Whether a firm will pay dividends is up to its board of directors -- the representatives of the common shareholders. Typically we see some pattern in the dividends companies pay: dividends are either constant or grow at a constant rate. But there is no guarantee that dividends will be paid in the future and, if paid, what the monetary amount will be.

A preferred stock is also an equity investment in the company. However, preferred shareholders have preference (i.e., seniority) over common shareholders with respect to both income and assets in the event of a liquidation of the company. In other words, a company must pay its preferred shareholders its dividends before it pays any dividends to common shareholders.

Preferred shareholders are in a similar situation as the common shareholders with respect to whether dividends will be paid. They expect to receive cash dividends in the future, but the payment of these dividends is up to the board of directors. But there are three major differences between the dividends of preferred and common shares. First, the dividends on preferred stock usually are specified at a fixed rate or dollar amount, whereas the amount of dividends is not specified for common shares. Second, preferred shareholders are given preference: their dividends must be paid before any dividends are paid on common stock. Third, if the preferred stock has a cumulative feature, dividends not paid in one period accumulate and are carried over to the next period. Therefore, the dividends on preferred stock are more certain than those on common shares.

4. Summary

The valuation of securities therefore requires first identifying the type, amount, and timing of the cash flows associated with the security. The valuation of debt securities is a bit more straightforward than the valuation of equity securities because the amount and timing of the cash flows are contractual. The valuation of stock requires estimating what dividends, if any, the company will pay in the future.

Once the amount and timing of the security's cash flows are estimated, the valuation of these assets requires the application of the time value of money mathematics to determine the present value of these future cash flows.

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