

Discounted Cash Flows & the Nature of the Firm

1. *Discounting Future Value*

Entrepreneurs and business managers are constantly presented with business propositions. Individual consumers face financial opportunities all the time. What is the right thing to do?

Let's assume that all economic agents are interested in maximizing their wealth when making decisions concerning the financial opportunities that are presented to them. By what criterion will assets and investment projects be evaluated?

Throughout the semester we will learn that maximizing present discounted value is the appropriate criterion for maximizing individual utility and that maximizing present discounted value is identical to profit maximization in the context of the competitive neoclassical firm. In terms of the latter point, because maximizing PDV is identical to profit maximizing, we know that social welfare is maximized in the Pareto sense when decisions are formed on this criterion.

In a practical sense, what does maximizing PDV mean? In the simplest problem, we can declare that a project is a positive or negative PDV venture. That is, we look at a project in terms of its net cash flows. We discount the net cash flows in each period back to the present and add them up. The sum is either positive or negative. PDV is often called discount cash flow analysis or DCF.

2. *The Theory of Discounted Cash Flow: Pricing of Stocks*

In theory, the value of a business depends on the expected future cash flows accruing to it. To show this, consider a publicly-traded corporation such as McDonald's Corp. Investors buy and sell McDonald's stock daily based on their expectations regarding the future differences between revenues and costs. Consequently, the stock is priced to account for the combined wisdom of all these investors' expectations of the cash flows accruing to McDonald's and, thus, to the stockholders who own the residual profits.

Formally, the pricing of McDonald's goes as follows. The payoff to owners of McDonald's stock comes in two forms, dividends and capital gains. We can think of the price today as the discounted present value of the dividend (assume the dividend is paid one year from today) plus the present value of the after-dividend price one year from today. That is,

$$P_0 = \frac{Div_1 + P_1}{1 + r}.$$

where P_0 is the price of the stock now, P_1 the price of the stock next year after the dividend is paid, Div_1 is the dividend paid next year, and r is the rate of return required by investors to hold this security.

Suppose McDonald's pays a \$2 dividend at the end of the year. After the dividend is paid, investors believe that McDonald's stock price will be \$25.50. They also believe that the riskiness of McDonald's stock is adequately represented with a discount rate of 10 percent. Applying the above formula, the current price of McDonald's stock is therefore

$$\$25 = [\$2 + \$25.50]/1.10.$$

But how is next year's price of \$25.50 determined? In the same exact way. Investors one year from now see a future dividend and an after-dividend stock price just as the initial investors saw.

$$P_1 = \frac{Div_2 + P_2}{1+r}.$$

Expanding over the future life of McDonald's, we have

$$P_0 = \frac{Div_1}{1+r} + \frac{Div_2}{(1+r)^2} + \frac{Div_3}{(1+r)^3} + \dots + \frac{Div_F + P_F}{(1+r)^F} \quad (1)$$

Thus, the current price of McDonald's stock reflects the expected stream of dividends over the future through period F which may be as far in the future as to approach infinity. In any event, period F is so far off in the future that this last term is virtually zero due to discounting (that is, \$1 dollar to be received in 50 years has a present value of less than 1 cent when discounted at 10 percent).

The pricing of McDonald's shares takes place on organized stock exchanges. Numerous market participants explicitly or implicitly make forecasts of the cash flows to McDonald's and discount them to obtain a "best guess" forecast of what the stock price of McDonald's should be. By the trades of these market participants, the forecasts become unbiased estimates of the stock price. When negative information regarding McDonald's is revealed to the market (say, an outbreak of mad-cow disease), McDonald's stock price decreases nearly immediately to reflect the smaller cash flows expected in the future. The stock price adjusts when the new information arrives, not when the changes to cash flows actually occur.

In the limit, when the future is indefinite, the pricing formula becomes:

$$P = \sum_{t=0}^{\infty} \frac{Div_t}{(1+r)^t} \quad (2)$$

And, when we can forecast future dividends based on their current level plus a growth rate, g , the formula simplifies further:

$$P = \sum_{t=0}^{\infty} \frac{Div_0 \cdot (1+g)^t}{(1+r)^t} = \frac{Div_0}{r-g} \quad (3)$$

3. Capital Structure

Businesses begin with an entrepreneurial idea. Initially the entrepreneur uses what money can be scraped together from personal and familial sources. Often the "ownership" arrangements at this point are informal, sometimes leading to bitter disputes.

If this initial entrepreneurial hurdle is achieved, the next step usually requires the infusion of additional capital. The next capital source comes from private investors who are called *venture capitalists*. Before outside investors will put their money into a project, they require a more formal ownership arrangement. At this point, if not before, it is necessary to specify a legal structure for the business. This form is a stock corporation.

There are other organizational forms that are recognized by the legal system. However, both in terms of their tax treatment and in terms of their organizational properties, they are inferior to the stock corporation.

The stock corporation defines the ownership of the firm to the stock holders. They are called the *equity owners* of the firm. Their respective claims to the firm are based on their prorata ownership of the stock. Ownership of the firm gives a financial claim to the value of the firm when all of its other legal obligations are satisfied. The clearest example of ownership, which is what most entrepreneurs and venture capitalists hope for at this stage, is that the stock holders are the people who are paid if some other entity wishes to buy the firm and take over its operation.

Venture capitalists require that the firm be organized formally as a stock corporation because this gives them a way to monitor their financial investment in the firm. Their fundamental concern is that they will be cheated by a charlatan masquerading as an entrepreneur. Furthermore, the stock corporation is a mechanism that precisely identifies the relative claims of the financial investors vis-à-vis the entrepreneur/founder.¹

After the venture capital phase, the firm will typically have resources to begin formal operations of some sort. At this point the firm can borrow money from a bank or other financial institution. Recognize that bank loans are another form of the infusion of financial capital. However, the bank has a different claim to the firm from the stock holders. The bank is paid a fixed return on its investment, and this fixed return represents a claim that is supposed to be satisfied before the equity ownership receive anything.²

Bank loans allow the company to expand operations. If the company continues to be successful, the next step is to raise additional equity capital. This is done by selling some shares of the corporation to the public in what is called an *initial public offering* (IPO). Making the equity interest in the firm publicly traded allows for the risk inherent in the venture to be spread across many investors in a process called diversification. Because of this, much more capital can be raised than would be the case if each investor were stuck in the endeavor for an indeterminate length of time. Publicly traded stock is the epitome of the *Fisher Separation Theorem* in practice.

Once the stock is publicly traded even more financing options are opened. The firm may now sell its own debt securities into the market rather than relying on bank loans. These securities are called corporate bonds. The firm may already have issued preferred stock, but if not, it is likely to do so at some point after it becomes publicly traded.³ Preferred stock offers a fixed claim to the cash flows of the firm that need not necessarily be satisfied each period but must be satisfied cumulatively before the common equity holders can press their claim to the firm.⁴ Preferred stock as well as corporate bonds may be *convertible* into common equity claims.

Finally, as the business envisioned by the entrepreneur takes hold and managers are put in place to oversee the enterprise, it is efficient to pay these managers by giving them claims to the equity value of the firm. These equity claims almost always come in the form of stock options. For instance, my friend's company, Ameritrade, gives stock options to the managers and

¹ This relative claim varies depending on the venture. An interesting paper would be to investigate the ownership stake of the founder in newly formed companies.

² In practice it is most often true that in the case of financial distress, the stock holders and the fixed return investors share the burden.

³ Another good research paper is to investigate the types of firms that use preferred stock. In particular, to what extent is preferred stock used in the capital formation process.

⁴ One would think that preferred stock claims should be a useful instrument in the venture capital phase. However, I have the sense that they are not often used.

directors that have a *strike* price at the level that the stock was trading when the individual was hired and are exercisable one year later. Hence, if the stock price increases over the year, the manager is wealthier by the increase in the stock price. Of course, if the stock price falls, the manager is no worse off, except in an opportunity cost sense.

4. *Securities Markets*

Looked at from the point of view of the budding enterprise, we see the use and get a sense of the value of a diversity of financial mediums. This diversity is supported in its own right by markets in which financial investors can mix and match their financial inputs in individual firms.

First and foremost of the financial markets is the stock exchange. The stock exchange is the place where the equity claims to publicly traded firms are bought and sold. The oldest stock market is the New York Stock Exchange. A lively and interesting history of the NYSE can be found in: Mulherin, J. Harold, Netter, Jeffery M., and Overdahl, James. "Prices are Property: The Organization of Financial Exchanges from Transaction Cost Perspective" *Journal of Law and Economics*. Vol 34. 1991. p591.

Other stock markets include the American Stock Exchange, regional exchanges, and the NASDAQ. The NASDAQ is a network of brokers offering stocks for sale. This network has grown massively riding the tide of the internet and threatens to put the older physical exchanges out of business.

In addition to stock markets, there are bond markets. Bond markets have historically been organized more along the lines of the NASDAQ as opposed to the NYSE. Bond traders work for large investment firms. They buy and sell bonds, mostly government bonds among themselves with semi-formal links to each other. Bond trading took off in the late 1970s and 1980s.

Associated with the expansion of the bond market, was the development of financial futures markets. Futures markets in commodities are old. The Chicago Board of Trade was founded in 1848. Until the mid-1980s its main activity was commodity futures. A commodity future is a contract to deliver or receive a specific amount of some agricultural product of a specific quality at a specific place at a specific point in the future. It is a contract for future exchange of a product. Actual exchange of products only occurs on about 5 percent of the futures contracts that are originally written.

In the mid-1980s, financial futures took off. Financial futures are contracts for the future delivery of a financial instrument. The most common is a U.S. Treasury bond.

Another financial asset that has developed in recent years is the asset backed security. These started as debt instruments that were linked to federally insured home mortgages. They have spread to non-insured mortgages on homes and automobiles and lease payments on commercial equipment. These securities in various forms represent pass-through claims to the interest and principal payments on consumer and commercial loans. The most liquid of these markets also have traded futures.

Finally, there are options markets. Options are traded on most stocks, on government bonds, and on some commodities. The options traded on government bonds and commodities are options for the delivery of futures contracts. Options on stocks are options for the future delivery of the stock.

Financial markets allow for ever increasing efficiency in diversification of the risk arising from economic activity and vagaries of nature.