Artificial Intelligence (AI) for Investments
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Lecture - 05

Valuation of common stocks. It is often said that there is no easy way to beat the market, that is, to predict superior investment performance. Remember our discussion on liquid and efficient markets. Still, one would like to price equity securities and compare the pricing across different company stocks. Also, there is a more fundamental reason to value securities, for example, stocks, that is, to see if managers are acting in the best interest of the firm.

For example, they should only accept those projects that increase the firm value. But to attain this objective, it is necessary to understand what determines a share's price. We start the discussion with the basics of trading operations and the functioning of exchanges. We explore why market values are important and, therefore, the need to establish well-functioning, liquid, and efficient financial markets.

Then we understand the fundamental principles of stock valuation and the use of DCF models to estimate the expected returns. DCF methods not only help value individual stocks but also entire businesses. We start with a simple one-period investment in the stock. Then we extend the argument for a multi-period investment to establish a generic formula for stock valuation. In this process, we also see how growth and superior returns affect stock price attributes such as price-earnings ratios.

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Trading of securities on exchanges. In this video, we will discuss the basics of trading operations and the functioning of exchanges. A large company such as Amazon has millions of shares being traded that is 507 million, and a market capitalization that runs in trillions, which is 1.735 trillion dollars. In such forms, investors comprise a small number of investors and a small group of large institutional investors such as pension funds and insurance companies.

If Amazon wants to raise more capital, it can do so by borrowing or selling new shares to investors. This issuance of new shares to raise capital occurs in primary markets. However, such primary markets are infrequent phenomena. Most of the trading takes place on the stock exchanges, often called trading in secondary markets. At these exchanges, investors buy and sell shares that are listed on the exchange.

Put simply, stocks are traded on exchanges often referred to as secondary markets. On these exchanges, buyers and sellers trade the stocks amongst each other. This kind of secondary trading transaction only transfers the ownership from one owner to the other and no new shares are created. These investor orders are often submitted to exchanges through brokers. Generally, modern electronic trading happens through two broad categories of orders, often referred to as market orders and limit orders.

A market order is an order to trade immediately at the best available prices. Limit orders state a price limit for execution. If that price limit is met, then only the order is executed. Till then, the limit order is stored in the exchange limit order book. Secondary trading has no direct impact on firm operations. Of course, this buying and selling activity reflects the approval or disapproval of shareholders on the actions of firm managers. And, therefore, has an indirect impact. The modern-day trading of securities on exchanges such as the New York Stock Exchange or the National Stock Exchange of India occurs on computer networks, often referred to as electronic communication networks, that connect traders and brokers with the exchange. Present-day trading requires these shares to be stored in the demetallized that is demat form, unlike the paper documentation that was there in the times of physical trading.

Most of the modern-day markets are auction markets where the auction is conducted by computers. In addition to auction markets, some markets are called dealer broker markets. In these markets, exchanges designate a market maker that is designated market makers or DMMs often called the dealer, who is willing to buy or sell a large volume of the specific security that exchanges. She provides buy and sell quotes in a continuous manner to maintain orderly trading at the exchange in a given set of securities.

These exchanges also summarize daily data on their websites for public consumption. This helps in wider information dissemination and facilitates efficient price discovery. To summarize, in this video, we discussed how modern financial markets leverage electronic communication networks and limit order books to facilitate a large volume of trades at an extremely fast pace. This helps an efficient price discovery through wide information dissemination.

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Market value of common stocks

	Market-to-Book-Value Ratio		Price–Earnings Ratio	
	Company	Competitors'	Company	Competitors'
Johnson & Johnson	3.4	3.0	11.3	10.9
PepsiCo	6.4	3.0	15.6	12.9
Campbell Soup	9.0	4.6	8.8	11.3
Wal-Mart	3.0	2.1	14.6	13.4
Exxon Mobil	2.9	1.2	7.6	5.3
Dow Chemical	0.5	3.0	12.5	10.6
Dell Computer	4.5	3.7	7.9	11.1
Amazon	11.2	2.7	46.9	22.2
McDonald's	4.4	3.1	14.1	13.6
American Electric Power	1.1	1.1	8.1	11.0
GE	1.0	1.7	4.6	8.8

Market value of common stocks. We understand why market values are important benchmarks to understand the performance of a firm as evaluated by the investors and other market participants. Every quarter, listed companies release their account; this includes a balance sheet with details of assets and liabilities. These values are called book values. It is a certain tangible number assigned to various firm parameters such as equity and assets, among others.

These accounting numbers are based on the opinions of auditors such as KPMG PWC and Deloitte. Also, these accounting numbers are prepared according to and following international financial reporting standards as adopted by the country in which the firm operates. So, why not rely on these book values for various requirements and applications? While the book value of an asset is a reassuring definite and tangible figure, it essentially measures its historical value or cost of acquisition after reducing the depreciation.

This may not be an accurate representation of what these assets are worth today. Organizations often purchase assets that have more value than their cost of acquisition. Remember the positive NPV rule. Therefore, the market prices of firm stocks are often more than their book values. Stock prices can also be less than book values if the firm is doing poorly and taking projects that have negative NPVs. Financial analysts often argue that markets are efficient; that is, prices observed in financial markets reflect the true and efficient value of the firms. However, very often, projects

businesses that need to be valued are not publicly traded. A financial analyst, while valuing such firms or a business, follows a method called valuation by comparable.

In this method, we identify a group of similar firms that are listed and publicly traded. That is, firms that operate with similar business risk and similar nature of operations. Then they try to examine how much the investors are willing to pay for these firms for each dollar of their assets or earnings as provided on their books. Therefore, two parameters become particularly important for such analysis.

The first market-to-book ratio that is, the market value of equity divided by the book value of equity. Second p ratio, share price divided by earnings reported in the profit and loss statement. Consider the hypothetical values of the market-to-book ratio and p-ratio provided here. The values are provided for firms, and the average values for competitors in their industry. In case these companies were not listed entities, then you would rely on the industry averages.

For example, consider Johnson and Johnson, if it was not listed, then you would have considered its equity to be of three times then of its book value and computed its stock price, or alternatively, you would have looked at its earnings and multiplied them by 10.9 which is the industry average. It is no guarantee that these two numbers will agree with each other very often; they may not. Still, these estimates ensure that you have some comparable benchmarks.

And your estimates from fundamental valuation methods, such as discounted cash flows, can be compared with the current market view. To summarize, in this video, we discussed that market price is observed as liquid and efficient markets are a useful tool to judge the firm performance and that of the projects undertaken by the firm. Investors and analysts often use market prices to value and compare firms with similar business risks.

Important ratios, such as market-to-book and price-to-earning ratios for a listed non-traded firm along with market prices of traded firms, help market participants understand how much investors are willing to pay for these unlisted firms for which market prices may not be available.

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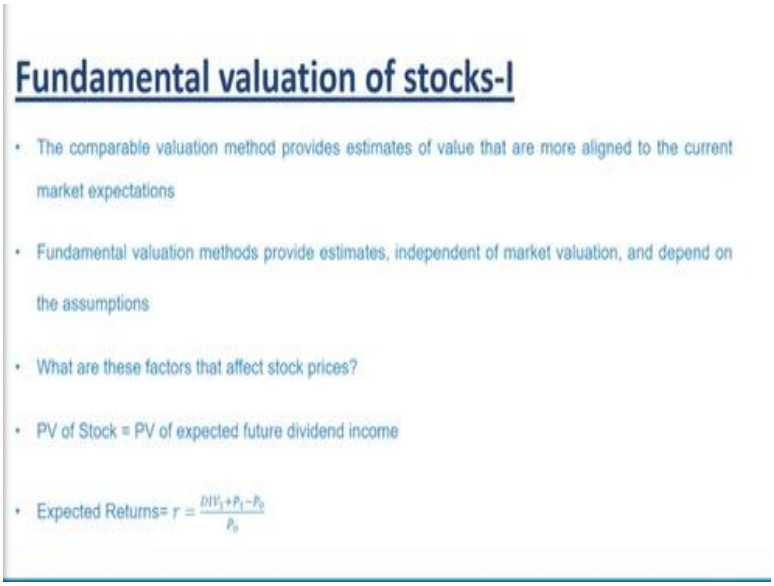

Fundamental valuation of stocks part 1, we will be introduced to the fundamental valuation of common stocks. We will apply a discounted cash flow which is a DCF valuation technique, to value common stocks. The comparable valuation method provides estimates of value that are more aligned with the current market expectations. However, it is no guarantee that these expectations are true and efficient.

For that, fundamental valuation methods provide rather appropriate estimates. In order to perform the fundamental valuation of stocks, we need to know what are these factors that affect stock prices. Recollect a previous discussion of discounted cash flow method. The same can also be applied to security, whether stock or bonds. Stockholders receive dividends from the company, it is easy to see where we are going with this.

The present value of all such dividends, if discounted with appropriate interest rates that reflect the rates of equity owners, should result in the value of the firm. That is, the present value of a stock is equal to the present value of expected future dividend income. Please note that when we are talking about dividends, these are not past dividend income. These are future expected dividends that depend upon the future ability or capacity of the firm to pay dividends.

Let us understand this through a simple example. When you plan to buy a stock, you expect your returns or payoffs in two forms. First, you expect to receive dividends; second, you expect capital

gains or sometimes losses. That is if you sell the shares, the price at which you sell may be different from the buy price. If things go well, you plan to sell this stock at a profit ofcourse these profits will come to you after paying the taxes.

Let us say that you bought this stock at a price P0 you plan to sell this stock next year. By the end of the year, the price is expected to be P1. And the firm has announced a dividend of DIV1 by the end of this year if you plan to compute the returns from this investment assuming no taxes, your return should be computed as shown here,

$$Expected\ returns = r = \frac{DIV_1 + P_1 - P_o}{P_0}$$

Notice that these are expected returns predicted by you not the actual returns. This is so because you are expecting a sale price of P1 at the end of the year. This may not be the actual price; the actual price can be more or less than the expected price. Now let us examine this discount rate r which is often called the market capitalization rate or cost of equity capital or the returns expected by shareholders given the risk of the firm. All the companies with the same risk will face the same discount rate.

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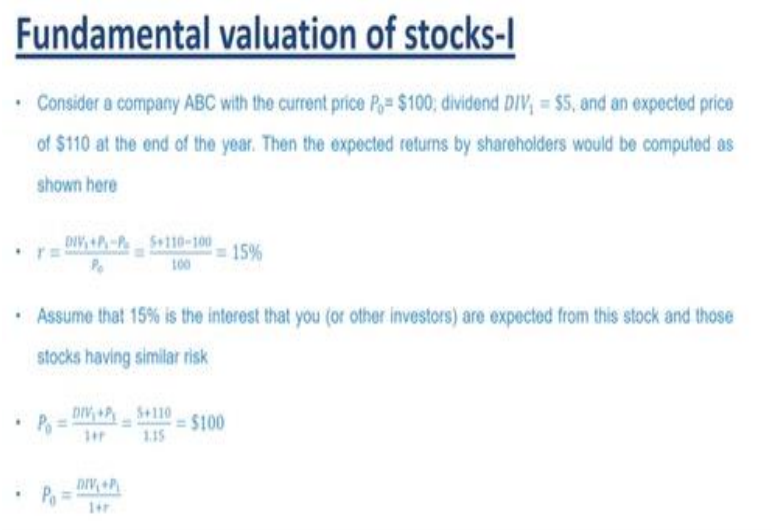

Let us put some numbers here. Consider a company ABC with the current price $P_0 = 100\ dollars$ dividends expected at the end of the year $DIV_1 = 5\ dollars$ and an expected price

of 110 dollars at the end of the year. Then the expected returns by shareholders would be computed as shown here,

$$r = \frac{DIV_1 + P_1 - P_0}{P_0} = \frac{5 + 110 - 100}{100} = 15\%$$

Let us make this example more interesting. Assume that 15% is the interest that you or other investors are expecting from this stock, and those stocks have a similar risk. The dividends $DIV_1 = 5\ dollar$ and the future expected price $P_1 = 110\ dollars$ are known to you. Now if you are asked to compute the present value of the stock, then what should be the fair and efficient price of the stock. You can simply discount the cash flows at the appropriate discount rate to estimate the true and efficient price.

The computation is rather simple as shown here

$$P_0 = \frac{DIV_1 + P_1}{1 + r} = \frac{5 + 100}{1.15} = \$100$$

A very important point to be noted here is that this 100-dollar price you compute it based on your expectation of the stock price one year from today and the discount rate based on this risk of the stock. The actual price at which this stock is trading may not be the same. For example, the actual price at which this stock is trading can be more or less.

However, if you truly believe in your computation and consumptions, then if the share price observed in the market is more than your estimates of the true and fair price, you would argue that the market price is overvalued. If the market is overvalued and many investors feel the same way, what should they do? They would shift their capital to other securities that are efficiently valued. As more and more investors do the same, the price of the security would fall and align with the efficient values estimated by the investors.

Similarly, if the market price observed is less than the true and efficient price computed by you, then you would argue that market prices are undervalued. Again, investors will place more and more capital in the stock, and its price will rise to become efficient. Remember our discussion of good systems of corporate governance wherein we said that investors buy or sell stocks to display

their approval or disapproval of manager selection of value-decreasing or increasing projects, this is precisely that mechanism.

To summarize, in this video, we examine the factor that affects the valuation of common stocks. Common Stocks are interesting instruments with an indefinite lifetime. Investors who own these stocks expect returns in the form of dividends and, finally, capital appreciation at the time of the sale of the share. Thus, the current value of the stock P0 can be expressed in the form of dividends DIV1 and capital appreciation at the end of the period in the following manner.

$$P_0 = \frac{DIV_1 + P_1}{1 + r}$$

where r is the market capitalization rate or cost of equity capital for the firm. Many times, the actual price may not be the same as the price estimated here then if the buyers or sellers actively trade in the market to drive it towards efficient values depending upon whether the share is under-priced or overpriced. This mechanism facilitates efficient price discovery and helps attain equilibrium in financial markets.

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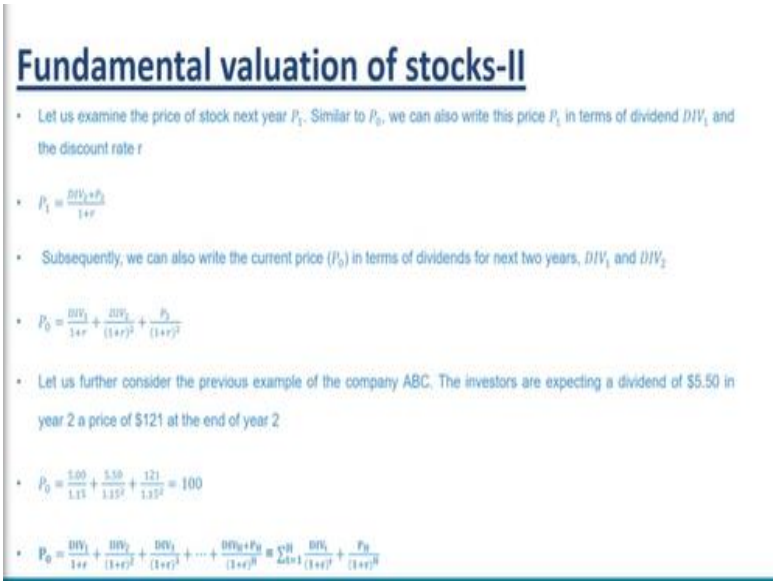

We will develop and understand a generic formula for the valuation of common stocks with the help of dividends. We will see how discounting the dividend cash flows helps in estimating the current share price. Till now, we have explained the current price of P0 in terms of this year's

dividend and the price that is expected at the end of the year P1. Let us move towards a more generic formula for the current year price P0.

Let us examine the price of this stock next year, that is, P1. Similar to P0, we can also write this price P1 in terms of dividend DIV2 price expected at the end of the second year P2 and discount rate r. This formula is shown here

$$P_1 = \frac{DIV_2 + P_2}{1 + r}$$

Subsequently, we can also write the current price, P0 in terms of dividends for the next two years DIV1 and DIV2, and price at the end of the second year, P2.

This is shown in the expression provided here

$$P_0 = \frac{DIV_1 + P_1}{1 + r} + \frac{DIV_2 + P_2}{1 + r} + \frac{P_2}{(1 + r)^2}$$

Let us further consider the example of the company ABC. The investors are expecting a dividend of 5.5 dollars in year two, a price of 121 dollars at the end of year 2. The current price can be easily estimated with these numbers as computed here,

$$P_0 = \frac{5}{1.15} + \frac{5.5}{1.15^2} + \frac{121}{1.15^2} = 100$$

This expansion of the current price P0 can be further extended to three, four, or more periods. It should be clear now where we are going with this. Consider a rather large horizon of which periods and the expected price at the end of the horizon as PH. The current price can be easily expressed in terms of dividends received during this period, and the price obtained at the end, that is, PH, this can be written as shown here.

$$P_0 = \frac{DIV_1}{1 + r} + \frac{DIV_2}{(1 + r)^2} + \frac{DIV_3}{(1 + r)^3} + \cdots + \frac{DIV_H + P_H}{(1 + r)^H} = \sum_{t=1}^{H} \frac{DIV_t}{(1 + r)^t} + \frac{P_H}{(1 + r)^H}$$

The expression $\sum_{t=1}^{H} \frac{DIV_t}{(1+r)^t}$ Indicates the discounted sum that is present values of dividends for years 1 to H. Thus, the value of the current share price P0 has two components, one the present value of dividends to be received over the investment horizon. Second the present value of the sale price at the end of the investment period.

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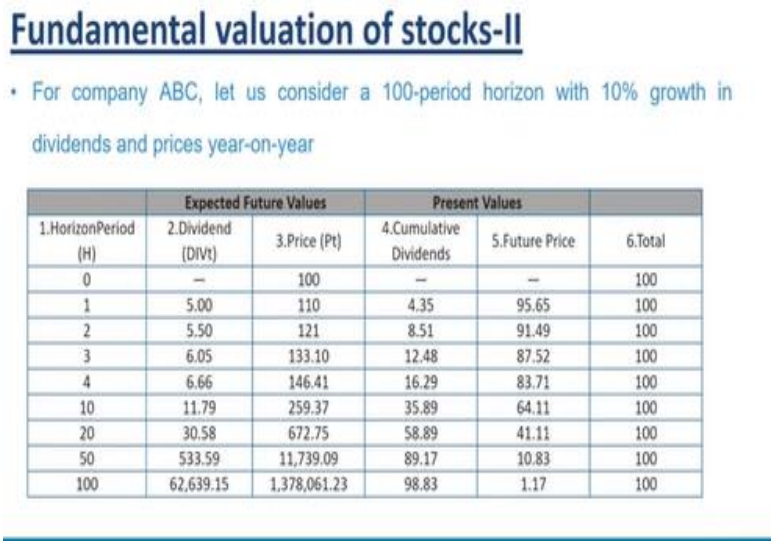

	Expected Future Values		Present Values		
1.HorizonPeriod (H)	2.Dividend (DIVt)	3.Price (Pt)	4.Cumulative Dividends	5.Future Price	6.Total
0	–	100	–	–	100
1	5.00	110	4.35	95.65	100
2	5.50	121	8.51	91.49	100
3	6.05	133.10	12.48	87.52	100
4	6.66	146.41	16.29	83.71	100
10	11.79	259.37	35.89	64.11	100
20	30.58	672.75	58.89	41.11	100
50	533.59	11,739.09	89.17	10.83	100
100	62,639.15	1,378,061.23	98.83	1.17	100

Let us put some numbers here with the following example, consider a 100-period horizon with 10 growth in dividends and prices year on year. The resulting figures are provided in the table shown here. Columns 2 and 3 represent the expected future values of dividends and prices, and column 4 presents the present value of the total expected dividends to be received if the stock is held till that year.

Column 5 represents the present value of the expected sale price for that year. For example, the investor that holds this stock for 100 periods will receive a total present value of 100 dollars. Out of this 98.83 dollars come from the dividends received over the investment period, and 1.17 dollars come from the sale of the share. Interesting to note that for all periods, the total present value, that is, PV remains the same at 100 dollars.

However, it may be noted that for investors with different horizons, the composition of present value that is PV of dividend and sale price varies.

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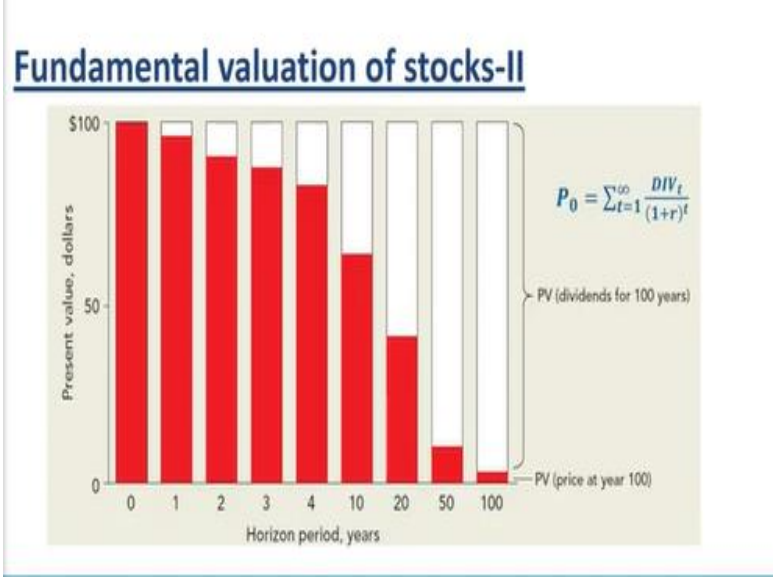

Let us examine these values with the help of the figure shown here. It can be easily observed that for investors with long horizons, the present value PV of dividends has the major share in the value of the current price. In contrast, for the investor with small horizons, the major share of the current price comes from the sale price and a rather small share from the PV of dividends. However, these two are not entirely different things. Essentially, even for short-horizon investors, the value of the sale price is determined by expectations of dividends only.

Therefore, we can obtain a more genetic expression for the current price P0 by assuming an infinitely large period. The key point to remember here is that as the investment horizons increase and H becomes infinitely large, the present value of the sale price approaches zero. The assumption of an infinitely large investment horizon in a stock is not unrealistic. Remember our discussion of the separation of ownership and control. This offers longevity to the firm, and the stock survives many human lifetimes.

Therefore, a resulting expression for the current price of stock simplifies as shown below is

$$P_0 = \sum_{t=1}^{\infty} \frac{50}{(1+r)^t}$$

At times this formula of discounting dividends may not seem very intuitive as it does not factor the capital gains. However, if you remember the assumption that was used to derive this formula, that is future prices that are used to compute capital gains are essentially determined by the future expectations of dividends only. Often, we get confused by thinking that the current price should

reflect the discounted present values of earnings. If one discounts the earnings, then it would be double counting of cash flows as the investment into plant and machinery would also be included in the earnings.

This investment has resulted in sustained and sometimes increasing dividend levels. Therefore, using earnings would lead to double counting of benefits, and it is only appropriate to use discounted dividends to compute the share price. Lastly, many companies, especially young growth firms with large capital requirements, do not pay dividends, and therefore their valuation becomes more complicated.

However, their valuations are also not inconsistent with this model. This is so because sometimes, in the future, their shareholders expect them to become profitable and distribute. These profits are in the form of dividends, or alternatively, they expect the share prices of these companies to soar and get their hands on money by selling a certain fraction of these shares held by them. This explains the share price of the firm that has been making losses.

For example, negative cash flows year on year for many years. To summarize, in this video, we discuss how simple one-period price estimation can be extended into generic formula of H periods. That is price can be expressed in terms of present values of dividends received over H periods and the capital appreciation through the sale of share at the end of the period.

We also noted that as the investment horizon increases, the present value of capital appreciation component declines as the investment horizon becomes infinite the current value of the share comes entirely from the expectations of the present value of dividends to be received in the future indefinitely. However, many young growth firms do not pay regular and stable dividends and in fact often incurr losses. Then this formula may not be easily applied to them.

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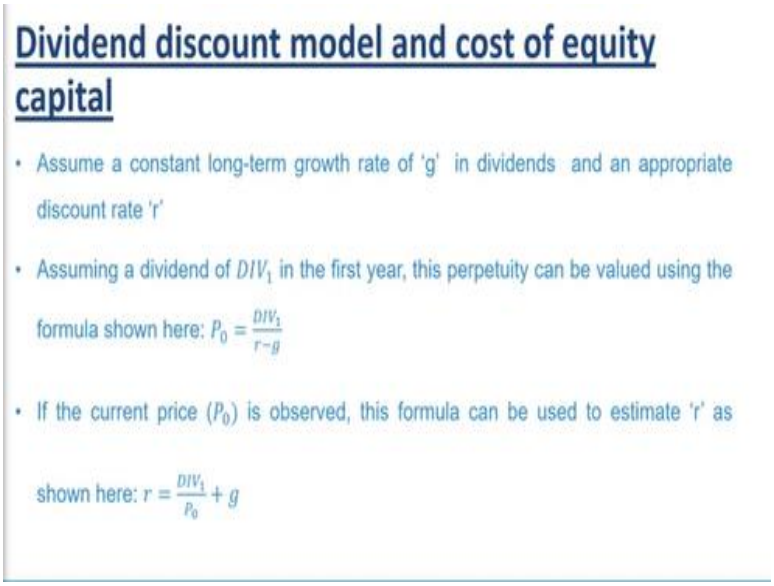

Dividend discount model and cost of equity capital. We will understand the valuation of companies with growing earnings and dividends. We will also understand the relationship between the growth cost of equity, that is, the market capitalization rate and dividend yield. Let us put our knowledge of DCF valuation through dividends to practice. Assume a constant long-term growth rate of g in dividends and an appropriate discount rate r.

This is similar to valuing that growing perpetuity, as we discussed in the previous topics. Assuming a dividend of DIV 1 in the first year, this perpetuity can be valued using the formula shown here.

$$P_0 = \frac{DIV_1}{r - g}$$

Again, this gives the anticipated growth rate and is less than r; for this formula to remain viable, the discount rate must be more than this growth rate. This growing perpetuity formula explains the current price P0 in terms of expected dividend DIV1 growth g ,and expected return on the securities of the same risk r, also if the current price P 0 is observed, this formula can be used to estimate r as shown here.

$$r = \frac{DIV_1}{P_0} + g$$

This formula shows that the discount rate r or expected returns equal the dividend yield;

$$\frac{DIV_1}{P_O} + g$$

this r is often referred to as the expected return or cost of equity.

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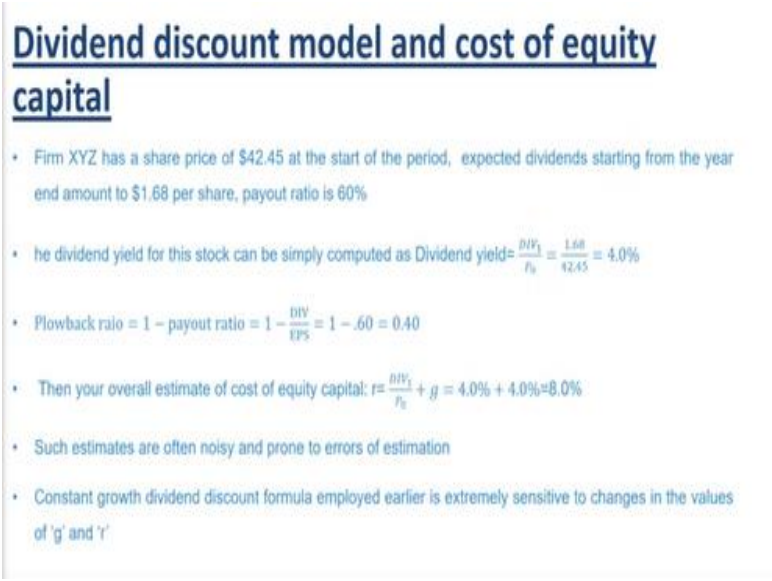

Let us understand this through a simple example if you wish to estimate this cost of equity for a firm XYZ having a share price of 42.45 dollars at the start of the period, also that expected dividends starting from the year-end amount to 1.68 dollars per share. The dividend yield for the stock can be simply computed as

dividend yield = $\frac{DIV_1}{P_0} = \frac{1.68}{42.45}$ = 4 percent.

The second part that is estimating long-term growth rate g is rather difficult.

Let us discuss this long-term growth rate. A simple argument to link with the payout ratio that is ratio of dividends to earnings. For example, if the payout ratio is 60 percent, that also means the company is plowing back 40 percent of earnings back into the business; that is plowback ratio = 1 - payout ratio = $1 - \frac{dividend}{earning\ per\ share}$ = 1 - 0.6 = 0.40.

This growth rate g can be expressed as written on equity and the amount invested back in the firm expressed in the form of plowback ratio.

Growth rate g equal to plowback ratio into return on equity if the return on equity is 10 percent and plowback ratio is 40 percent then the growth rate g can be calculated with the simple formula $g = 40\,percent * 10\,percent = 4\,percent$. If the estimate of this growth is 4 percent then your overall estimate of cost of equity capital are for the firm XYZ can be easily shown here,

$$r = \frac{DIV_1}{P_0} + g = 4\% + 4\% = 8\%$$

Please note that this estimate of cost of equity is at best an estimate only.

Such estimates are often noisy and prone to errors of estimation. These estimates such as r if computed using single company data then this noise can be rather high. To improve these estimates, it is advisable to use multiple companies that is large sample of equilateral securities and consider average estimates. These averages often help in reducing the noise component that is often associated with single company estimates.

Also please note that the constant growth dividend discount formula employed earlier is extremely sensitive to changes in the values of g and r. Therefore, before applying this formula, one may need to be sure that the current high rates of growth may not be sustainable in the long term, that is the constant growth DCF formula assumes the growth rate due to continuing perpetuity.

Organizations often witness periods of high growth rates due to favourable operating environments. However, these high growth rates are not sustainable in long term. Thus, the assumption of long-term growth g needs to be made with caution. Consider this example of a firm with equity of 25 dollars, dividend at the end of the year $DIV\ 1 = 0.5\,dollars\ and\ P_0 = 50\,dollars$ that is current price.

The firm has an ROE that is written on equity of 25 percent and pay out ratio of 20 percent. Let us first compute the cost of equity for this firm. With the simple constant growth DCA formula the return on equity that is ROE can be simply computed in two steps as shown here, first $dividend\ growth\ rate = (1 - pay\ out\ ratio) * return\ on\ equity = (1 - 0.2) * 0.25 = 20\,percent$.

Notice that this growth rate seems to be unusually high, the cost of frequency computed with this growth rate would work out to

$$r = Dividend\ yield + g = \frac{0.5}{50} + 20\% = 21\%$$

But of course, we know better. No firm can sustain a growth rate of 21 infinitely into future. In real life such growth rates stop gradually over the years and attain that lower long-term growth that is sustainable.

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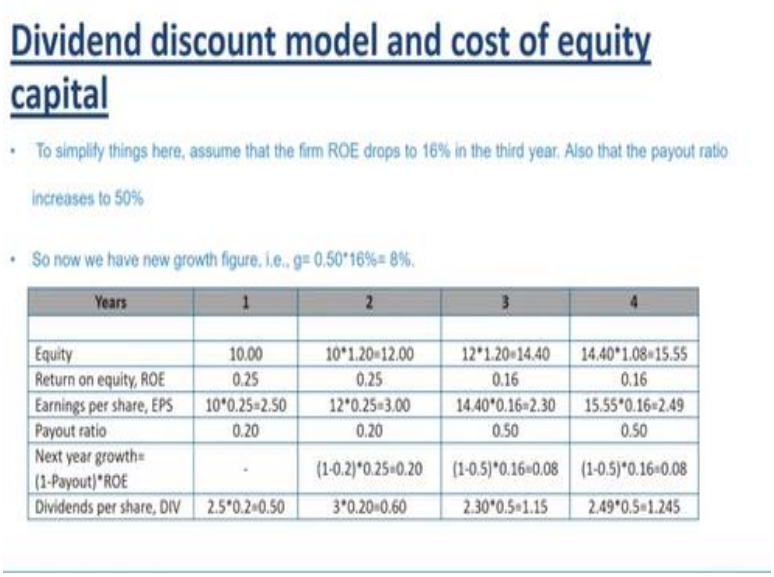

Years	1	2	3	4
Equity	10.00	10*1.20=12.00	12*1.20=14.40	14.40*1.08=15.55
Return on equity, ROE	0.25	0.25	0.16	0.16
Earnings per share, EPS	10*0.25=2.50	12*0.25=3.00	14.40*0.16=2.30	15.55*0.16=2.49
Payout ratio	0.20	0.20	0.50	0.50
Next year growth= (1-Payout)*ROE	-	(1-0.2)*0.25=0.20	(1-0.5)*0.16=0.08	(1-0.5)*0.16=0.08
Dividends per share, DIV	2.5*0.2=0.50	3*0.20=0.60	2.30*0.5=1.15	2.49*0.5=1.245

To simplify things here assume that the firm ROE that is written on equity drops to 16 percent in the third year. Also, that the pay out ratio increases to 50 percent it is natural for firms to increase the pay out ratio during initial growth phases it is usual for firm to plowback larger portion of earnings however, as the firm matures investment opportunities domination and more and more earnings are available for distribution among shareholders.

So, now we have new growth figure that is $g = 0.50 * 16 = 8\ percent$. Let us see the timeline of cash flows as shown here.

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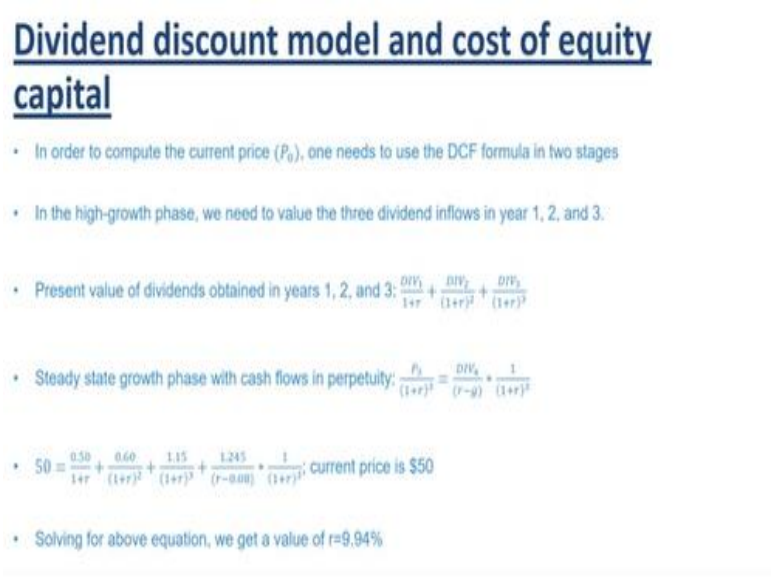

In order to compute the current price P 0, one needs to use the DCF firm line two stages, first the high growth phase and second the steady state growth phase. In the high growth phase, we need to value the three dividend inflows in year 1, 2 and 3.

Present value of dividends obtained in years 1, 2 and 3= $\frac{DIV_1}{1+r}+\frac{DIV_2}{(1+r)^2}+\frac{DIV_3}{(1+r)^3}$

Steady state growth phase with cash flows in perpetuity can be valued simply as shown here.

$$\frac{P_3}{(1+r)^3}=\frac{DIV_4}{r-g}*\frac{1}{(1+r)^3}$$

We also know that the current price is observed as 50 dollars the resulting expression is provided here,

$$50=\frac{DIV_1}{1+r}+\frac{DIV_2}{(1+r)^2}+\frac{DIV_3}{(1+r)^3}$$

$$50=\frac{0.50}{1+r}+\frac{0.6}{(1+r)^2}+\frac{1.15}{(1+r)^3}+\frac{1.245}{r-0.08}*\frac{1}{(1+r)^3}$$

Solving for this equation we get a value of r = 9.94%. These PV computations employed a two-stage DCF valuation model. In the first stage the high growth phase the firm was highly profitable that is written on equity = 25% and it plowed back 80% of earnings. This resulted in a high growth rate of 20%. Third year onwards profitability declined and pay out increased that is dividends increased that is less money plowed back the long-term growth rate settled at a steady state rate of 8%.

This example can be suitably extended to three or more stages of different growth regimes, for example first phase at growth rate of 20 percent. Second phase of 12 percent and finally the steady state at growth rate of 8 percent. In this case the present value will be computed in three stages. We closed this discussion with a caveat that chances are your DCF valuation of stock may not be consistent with those observed in the financial markets.

This could be due to the fact that markets may not agree with your growth projections or dividend forecasts or cost of equity capital estimates. Small variations in any of these estimates often lead to wide variations in stock valuations. To summarize in this video, we computed the current share price for firms with growing earnings and dividends using the dividend growth model shown here, that is

$$P_0 = \frac{DIV_1}{r - g}$$

here g is the anticipated long-term steady state growth rate.

This growth rate is generated by investing in new projects that is flowing back money into firm operations. This will also reduce the pay out ratio that is the level of dividends. This relationship between growth written on equity and pay out ratio can be expressed as noted here growth rate $g = plowback\ ratio * return\ on\ equity$ where $plowback\ ratio = 1 - pay\ out\ ratio$. We also noted that firms may often exhibit high growth rates in the short term.

These growth rates may not be sustainable in long term and therefore the dividend discounting formula needs to be employed in different stages. The final stage where perpetual cash flow formula is employed should comprise the maturity state with steady state growth.

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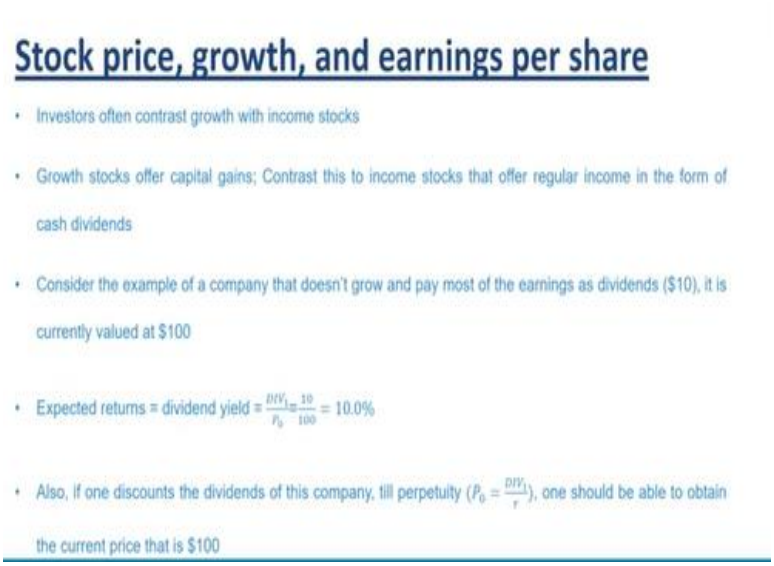

Stock price growth and earnings per share, we will understand the difference between the growth stocks and income stocks. We will also examine the concept of the present value of growth opportunities PVGO in this context. Investors often contrast growth with income stocks. Growth stocks offer capital gains this is ascribed to the fact that these stocks have high future earnings growth potential and therefore the appreciation in prices.

Contrast this to income stocks that offer regular income in the form of cash dividends. This is an interesting difference. Consider a simple example of a company that does not grow at all. It pays out most of the earnings and does not plowback any thus it produces a constant stream of cash flows in the form of dividends similar to a perpetual bond. Mature companies with stable operations rarely find projects with abnormal returns.

So, it is not unusual for them to distribute a large share of earnings to stockholders. If liquid and efficient from markets are available these stockholders can invest the money in financial markets according to their risk tolerance inappropriate investments. If this company pays all of its earnings as dividends amounting to 10 dollars and is currently valued at 100 dollars then one can easily compute its unexpected returns as shown here.

$$Expected\ return = dividend\ yield = \frac{DIV_1}{P_0}$$

which is also in this case same as earnings price ratio, that is EPS_1/P_0 here EPS_1 is earnings per share. In this case $expected\ returns\ = \frac{10}{100}\ =\ 10\ percent$. This is the expected interest rate or the rate of return expected by shareholders from this firm also F 1 discounts the dividends of this company till perpetuity that is $P_0 = \frac{DIV_1}{r_1}$ should be able to obtain the current price that is 100 dollars.

Let us consider the case of a growth firm. This firm is investing most of its earning internally rather than paying dividends. Let us assume that this is an investment of 10 dollars at the end of year t = 1. This would also mean no dividends next year the company also expects that it this investment opportunity has a return of 10 percent which is same as the market capitalization rate that is returned that is also expected by current shareholders.

That means in each of the subsequent years the company would add an additional one dollar from this investment. Let us try to value this opportunity with DCF valuation technique. Net present value that is

$$NPV = -C + \frac{DIV_1}{r} = -10 + \frac{1}{0.10} = 0$$

This is an interesting but unexpected result. The result suggests that this project opportunity did not add any value to the firm.

The reduction in value due to loss of dividends was 10 dollars is exactly offset by the additional perpetual dividends worth one dollar generated from this project. For the firm NPV of this project is 0. Mathematics apart the simple financial reason is that this project offered a return of 10 percent that was the market capitalization rate of the firm. That is investors were expecting a return of 10 percent on their investment in the firm.

That means if the firm distributed these cash flows to investors, they would have obtained the same 10 percent returns by investing in financial market instruments of the same risk. Therefore, they do not have any additional value to firm because of this investment.

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Stock price, growth, and earnings per share

- Let us consider four examples of different returns from this project

Project Rate of Return	Incremental Cash Flows	Project NPV in year 1	Project contribution to firm value at T=0	Share Price at T=0, P0	P0/EPS1	r
0.05	.50	-10+0.5/0.10=- 5.00	-4.55	95.45	9.545	0.10
0.10	1.00	-10+1.0/0.10=0	0	100.00	10.000	0.10
0.15	1.50	-10+1.5/0.10= 5.00	+ 4.55	104.55	10.455	0.10
0.20	2.00	-10+2.0/0.10= 10.00	+ 9.09	109.09	10.909	0.10

- Please observe that in those cases where NPV is negative, the price to earnings ratio is less than 10 and more than 10 where NPV is positive
- The value of price can be distributed in two components. First component, the capitalized value of earnings under no-growth policy; Second component, is the present value of growth opportunities (PVGO)
- $P_0 = \frac{EPS_1}{r} + PVGO$ or $\frac{EPS_1}{P_0} = r(1 - \frac{PVGO}{P_0})$

Let us consider four examples of different returns from this project. We compute the current share price for all these different returns. Please observe that in those cases where NPV is negative the price to earnings ratio is less than 10 and more than 10 NPV is positive also where the NPV of the new project is 0 the P ratio is 10. This also gives some intuition that the value of share price can be distributed in two components.

First component the capitalized value of earnings under no growth policy that is the case where there are no projects with returns of more than capitalization rate of cost of equity capital. Second component is the present value of growth opportunities that is PVGO. This relationship can be shown here as

$$P_0 = \frac{EPS_1}{r} + PVGO \; or \; \frac{EPS_1}{P_0} = r\left(1 - \frac{PVGO}{P_0}\right)$$

This formula suggests that earnings to price ratio will be equal to the cost of equity that is market capitalization rate. If there are no growth opportunities however if there are growth opportunities projects with positive NPVs this formula will underestimate r. If the managers invest money in projects with negative NPVs then the formula below will estimate the value of r also for an income stock a firm invest in projects that have zero NPV the future expected earnings and dividends may still grow.

But this growth will have zero NPV that is no contribution to the current price. Therefore, the stock will still not be a growth stock and in the sense will remain income stock only. Moreover, if the

company invests in a project with negative NPV that is a projected below market capitalization rate the earnings may increase but the share value will reduce.

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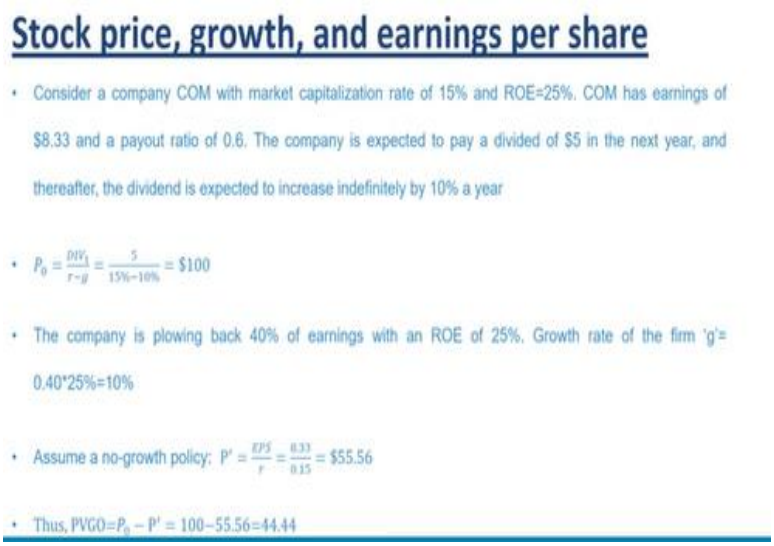

We will illustrate the computation of PVGO with a simple numerical example. Consider a company COM with market capitalization rate of 15 percent and return on equity that is ROE of 25 percent. COM has earnings of 8.33 dollars and the pay out ratio of 0.6. The company is expected to pay a dividend of 5 dollars in the next year and thereafter the dividend is expected to increase indefinitely by 10 percent a year.

We can use our perpetual growth DCF formula to work out the current share price as shown here

$$P_0 = \frac{DIV_1}{r-g} = \frac{5}{15\% - 10\%} = \$100$$

The company is plowing back 40 percent of earnings with an ROE that is written on equity of 25 percent. Growth rate of the firm g = 40 percent into 25 percent = 10 percent. As in hypothetical case assume a no growth policy that is all earnings are distributed or plowed back in projects that offer returns that are the same as market capitalization rate of 15 percent.

But in that case the price or market capitalization value would have been

$$\frac{EPS}{r} = \frac{8.33}{0.15} = \$55.56$$

But we already know that this value of is 100 dollars. Remember our earlier discussions the difference of $100 - 55.56 = 44.44$ dollars must be the amount that investors are paying for growth opportunities available with the firm that is PVGO.

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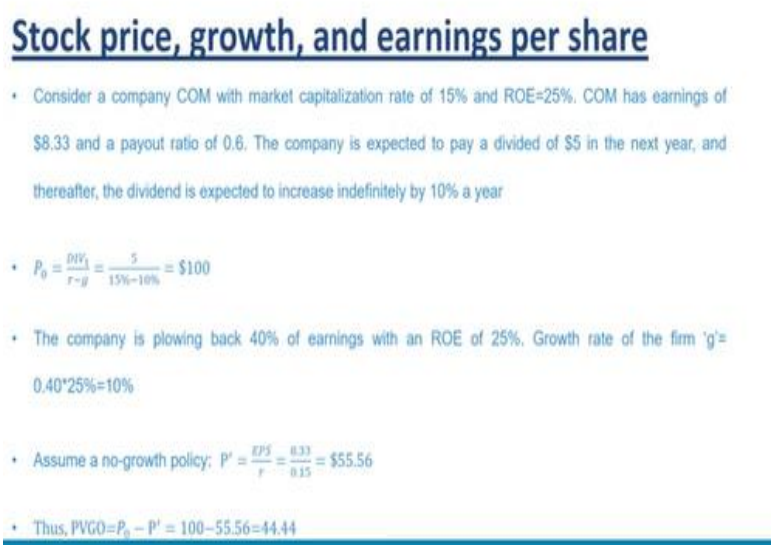

Let us try and break down this figure of 44.44. The company plows back 40 percent of earnings in the first year, in the first year this amount is $8.33 - 5 = 3.33\ dollars$. This amount is invested at a return of 25 percent that $is\ 3.3 * 25 = 0.83\ dollars$ earning starting from year two. The present value of this investment at equal to 1 can be computed as shown here

$$-3.33 + \frac{0.83}{0.15} = \$2.22$$

Also, it is known to us that firms earnings are growing at 10%. Therefore, we can expect this 2.22 dollar additional earnings to also grow at the same rate of 10% that means in the second year we will have an additional earning of $2.22 * 1.10 = 2.44\ dollars$ and $2.44 * 1.1 = 2.69\ dollars$ in the third year and so on. At 10% capitalization rate, let us compute the present value of all these incremental cash flows starting from the year one at 2.22 dollars.

This can be computed as shown here $PVGO = \frac{2.22}{0.15-0.10} = \$44.44$

This also confirms our earlier postulation that is the current value of share price equal to present value of earnings plus present value of growth opportunities. In this case we can compute the current value of share price as shown here

$$P_0 = \frac{EPS_1}{r} + PVGO = 5556 + 44.44 = 100$$

Please note that COM is not a growth stock because its earnings are going at 10 it is a growth stock because the PV of its future investments account for a significant portion of about 44 percent of its stock price. Thus, today's stock price reflects investor expectation about earning power of the firm's current value and future assets. To summarize in this video, we discussed the key differences between the growth stocks and value stocks.

Growth stocks have high future earning potential this is ascribed to the fact that these firms have projects with positive NPVs when discounted the market capitalization rate of the firm. In contrast an income stock does not have positive NPV projects and therefore may find it suitable to pay out most of the earnings in the form of dividends. The key difference between these two kind of stocks can be examined with the help of the present value of growth opportunities, that is PVGO.

For growth stocks PVGO comprises a major share of the firm value. By contrast for income stocks PVGO has a very small fraction of the overall firm value.

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A simple example of business valuation

- Let us start with some basic information and assumptions about this business
- The business has an appropriate discount rate of 10%. The business grows at a rapid pace of 20% per annum for five years, the falls to 13% for years 6-7, and finally settles down at a 6% steady state growth rate thereafter. Returns on asset (RoA) amount to a constant 12%. The plowback ratio is derived from the expected growth of the business, using the formula g= RoA (or RoE)* Plowback ratio. Starting with a size of $10Mn in the first year, the cash flows are provided here

Years	1	2	3	4	5	6	7	8	9	10
Growth (%)	20%	20%	20.0%	20.0%	20.0%	13%	13%	6%	6%	6%
Asset value ($Mn)	10.00	12.00	14.40	17.28	20.74	23.43	26.48	28.07	29.75	31.54
RoA*	12.0%	12.0%	12.0%	12.0%	12.0%	12.0%	12.0%	12.0%	12.0%	12.0%
Earnings ($Mn)	1.20	1.44	1.73	2.07	2.49	2.81	3.18	3.37	3.57	3.78
Plowback	167%	167%	167%	167%	108%	108%	50%	50%	50%	50%
Net investment ($Mn)	2.00	2.40	2.88	3.46	2.70	3.05	1.59	1.68	1.79	1.89
Free cash flows ($Mn)	-0.80	-0.96	-1.15	-1.38	-0.21	-0.23	1.59	1.68	1.79	1.89

A simple example of business valuation with DCF method. Build value in entire business using our discounted cash flow that is DCF valuation method. Let us start with some basic information and assumptions about this business. The business has an appropriate discount rate of 10% the

business grows at a rapid pace of 20 per annum for five years. Then falls to 13 for year 6 and 7 and finally settles down at the 6% steady state growth rate thereafter.

A return on asset ROE amounts to a constant 12% the plowback ratios derived from the expected growth of the business. Using the formula g = return on assets or return on equity plowback ratio starting with an amount of 10 million dollars in the first year the cash flows are provided here. please note assuming know that in the business would also mean that assets reflect the equity investment. Therefore, ROE would be same as ROE.

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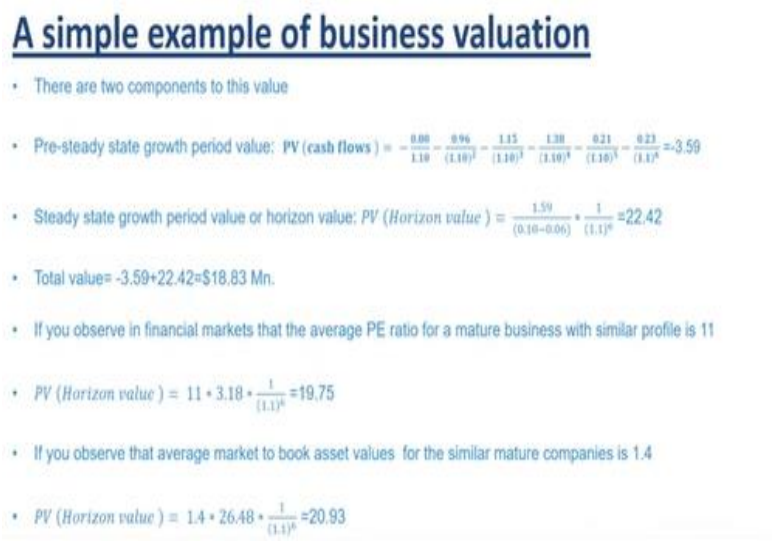

There are two components to this value. The value of cash flow still here 7 before the steady state growth rate is achieved, horizon value of cash flows from year 8 onwards. When the steady state growth is achieved let us value these two components. Pre-steady state growth rate period value that

$$PV\ of\ cash\ flows = -\frac{0.80}{1.10} - \frac{0.96}{(1.1)^2} - \frac{1.15}{(1.1)^3} - \frac{1.38}{(1.1)^4} - \frac{.21}{(1.1)^5} - \frac{.23}{(1.1)^6} = -3.59$$

Then steady state growth period value or horizon value the present value of horizon value

$$PV(horizon\ value) = \frac{1.59}{0.10 - 0.06} * \frac{1}{(1.1)^6} = 22.42$$

$total\ value\ of\ -\ 3.59\ +\ 22.42\ =\ 18.83\ million\ dollars$. It should be slightly troublesome for us that more than 8, 100 percent of the business value is coming as horizon value which is extremely sensitive to the steady state growth assumption.

Therefore, this method to arrive at the value may look mathematically elegant but the values obtained can deviate a lot from their fair and efficient values. A slightly more evolved method to compute these horizon values is to extract the PE ratios for more mature companies traded in financial markets. For example, if you observe in financial markets that the average PE ratio for a mature business with a similar profile is 11.

That is investors in efficient markets are paying 11 dollars price for each dollars of earnings then you can easily compute the horizon value in this case as provided here.

$$PV(Horizon\ value) = 11.318 * \frac{1}{(1.1)^6} = 19.75$$

Or one can also observe the market to book values of mature companies. For example, if you observe that average market to book a set values for the similar mature companies 1.4.

That is for each dollar book value of a set investors are willing to pay 1.4 dollar in the market then one can easily compute the horizon value of the firm as shown here that is

$$present\ value\ of\ a\ horizon\ value = 1.4 * 26.48 * \frac{1}{(1.1)^6} = 20.93$$

These values provide comparable benchmarks to ensure that our figures have a sense of reality and incorporate the current market expectations.

Again, these numbers are also only estimates and do not provide the complete truth. Nonetheless this is a useful number to help us estimate what investors are currently willing to pay. To summarize in this video, we valued an entire business with the help of free cash flow to firms. We started by projecting the links investment plowback and finally the cash flows. We also made certain assumptions about the growth of the business.

The projected cash flows are divided in three stages depending upon their cash flow profile. The last stage is considered where cash flows have attained a long-term steady state growth rate. The cash flows in this stage are valued using the perpetuity formula and are referred to as horizon value. Finally, we computed the present value of these cash flows and sum them up to value the entire business.

This valuation may be considered with the following caveat. The horizon value or terminal value is a major component of all the overall value of the business. This value is extremely sensitive to the assumption of market capitalization rate and steady state growth rate assumptions. To summarize in this lesson, we applied our knowledge of DCF evaluation technique to value common stocks and business.

Essentially the value of stock is equal to the discounted dividend payments expected to be received in perpetuity. Here the discount rate is the rate of interest investors expect to receive on other securities with the same risk. Since common stocks do not have a fixed maturity the dividend payments comprise an indefinite stream of dividends. The resulting formula to compute the value of a common stock has been discussed in this lesson.

However, investors often do not plan to hold the stock for eternity and have finite investment horizons. These investment horizons involve returns in the form of dividend and capital gains. For example, in our previous discussions we noted that in investor plans to hold a stock for one year his investment horizon is only one year. Also, his expecting returns in the form of dividends and capital appreciation that is increase in the share price.

Thus, the price that she is willing to pay today can be expressed in the form of dividend received during the year and the expected price received at the end of the year. At which she is hoping to sell the stock. The resulting expression has been shown in the lesson and this logic can be extended to holding periods of 1, 2, 3 and further years. This formula also represents the market equilibrium if the price deviates from these values and the stock is overpriced or under-priced.

And do not match with the investor expectations of fair and efficient value of the stock. In that case buyers or sellers would participate in large volumes to buy the enterprise security and sell the overpriced security. This access buying and selling of security will force the stock price to become efficient and aligned to market expectations and reach market equilibrium. We also applied the concept of indefinitely growing perpetuity to value the stocks with infinite stream of dividends.

We also discussed several problems associated with this formula. This formula assumes constant dividend growth in perpetuity. If the firm is yet to attain a steady state growth phase, then one needs to discount the dividend on to 1, 2, 3 or more stages depending upon the nature of growth. The last stage would comprise the steady state growth phase with the growth g which is employed to compute the horizon values.

With the help of this formula, we derived a price formula where the current value of share price is broken into two components. The first component based on discounted earning per shares and second present value of growth opportunities. Here the first component represents the capitalized value of earnings that firm would generate under no growth assumption. That is all the earnings distributed to shareholders.

The first component PVGO present value of growth opportunities in the net present value of growth opportunities that is investments into those projects that have a positive NPV when discounted at the market capitalization rate. These investments will help the firm grow here a growth stock is considered where the PVGO is large related to the capitalized value of EPS. These growth stocks are rapidly expanding firms with profitable units investments.

The valuation of entire business can also be performed using DCF valuation techniques by discounting the free cash flow to business. Usually, free cash flows are forecasted up to a certain horizon where steady state growth rate is achieved. These cash flows are discounted and their present value is computed. In addition, a horizon value is computed by discounting steady state growth cash flows as perpetuity.

Both of these values are added to obtain the value of the business. This two-stage discounting procedure can be extended to three stages or more depending upon the growth profile of the firm. Estimating these horizon values extremely difficult task. This is so because horizon values form a major portion of the overall form value. Moreover, these horizon values are extremely sensitive to the assumption of growth rates and cost of equity capital.

Usually, a long-term steady state growth rate is considered for this purpose then the growing perpetuity formula is employed to estimate the horizon value. One can also obtain the price to earning that is PE ratio or market to book ratios from the mature firms traded on exchanges. These ratios can be used to compute firm values at steady state growth rates and then discounted subsequently to obtain their present values.