

# Stock valuation

## 266: Financial Markets and Institutions

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### ► Equities

- We've examined what stocks (equities) are
- And the broad behavior of stock indices world wide.
- The value of a stock index is a summary of all the prices of the individual stocks
- Now we will present some basic theories intended to help us understand equity valuation.
- None of the theories is entirely successful: experts and market participants both are often puzzled by stock movements.
- But the theories are very useful in structuring our thinking

And they shed some light on why equity valuation is so hard.

### ► Valuation of securities such as equities

#### ► Standard approach

- The basic building block for assessing the value today of any item that has ongoing value is the concept present value.
- The present value, future value, and an interest rate are linked by an identity

#### ► Present value 1 yr. in future

- The dollar value of an item 1 year in the future is linked to the present value by:

$$PV = \frac{FV}{1 + i}$$

Present value equals future value divided by 1 plus the interest (or discount) rate.

- We say that the discounted present value today of FV tomorrow is  $FV/(1+i)$  where  $i$  is the discount rate.
- Since  $i > 0$  (usually!?!), the present value of \$1 tomorrow is less than \$1.

That is, we'd prefer having a dollar now to having a dollar in a year's time.

► **Three versions**

- Three ways to say same thing:

$$\begin{aligned} PV &= \frac{FV}{1+i} \\ (1+i) &= \frac{FV}{PV} \\ FV &= PV(1+i) \end{aligned}$$

- Practice the 'word' versions of each of these

► **Present value  $h$  years in future**

- We state interest rates at an annualized rate

The rate of change in value *per year*

- This means that if the future value is coming in  $h$  years, we must raise  $(1+i)$  to the  $h^{\text{th}}$  power to get the proper discounting:  $(1+i)^h$ .

let's explain that... b

► **Present value  $h$  years in future**

- The dollar value of an item  $h$  years in the future is linked to the present value by:

$$(1+i)^h = FV/PV$$

- Equivalently,

$$\begin{aligned} PV &= FV(1+i)^{-h} \\ FV &= PV(1+i)^h \end{aligned}$$

► **Aside::  $h^{\text{th}}$  power: explanation**

- If you start with  $PV_t$  at time  $t$  and the value grows at the rate  $i$  for a year, then at the end of the year you'll have:

$$FV_{t+1} = PV_t(1+i)$$

- At the end of two years, you'll have

$$FV_{t+2} = FV_{t+1}(1+i) = PV_t(1+i)^2$$

- At the end of  $h$  years, then,

$$FV_{t+h} = PV_t(1+i)^h$$

► **Aside:: Annualized interest rate**

- There are many different conventions for turning growth over  $h$  years into an ‘annualized rate.’
- This is no different from saying that there are various conventions about how to refer to a distance: in inches, or kilometers, light years, . . . .

or we can measure values in dollars, or yen, or euros

- So long as you pay attention to which convention you are using, you can properly adjust and everything works fine.

► **Aside::**

- In practice, there are laws and rules about which convention for annualizing should be used when.

see the supplemental notes on annualized rates go

<http://e105.org/e266/download/simpleAnnp.pdf>

► **Back to equity valuation**

► **1-period equity valuation**

- Suppose we buy a share in ABC corp. at time  $t$  and plan to sell in 1 year.
- How much cash will we have in a year?
  - Whatever we get for selling:  $P_{ABC,t+1}$ , plus
  - Any dividend the stock paid,  $D_{ABC,t+1}$ .

For simplicity, let's assume the stock pays dividends only at the end of the year.

- Present value is future value divided by the appropriate interest rate, so

$$P_{ABC,t} = \frac{P_{ABC,t+1}^e + D_{ABC,t+1}^e}{1 + i_{ABC,t+1}^e}$$

Where we've added those red *es* to indicate that the future variables are not known with certainty.

Our theory relates the ‘expected’ future values to the present value

► **Our first valuation model in words**

- The price of a stock today is the present value of the expected price plus expected dividends in a year's time.

► **Put another way**

- Using our three versions of the fundamental present value relation, we have

$$1 + i_{ABC,t}^e = \frac{D_{ABC,t+1}^e + P_{ABC,t+1}^e}{P_{ABC,t}}$$

One plus the expected return for holding the stock for a year is the expected future value over current price.

► **The generalized dividend valuation model**

- Suppose we consider holding ABC indefinitely.
- Then, our expected future value will be  $D_{ABC,t+1}^e$  one year from now,  $D_{ABC,t+2}^e$  in 2 years, and so on.

each year there will be a dividend.

- We say that we have a stream or flow of expected dividends,  $D_1^e, D_2^e, \dots$
- The present value at time  $t$  is:

$$P_{ABC,t} = \frac{D_{ABC,t+1}^e}{(1 + i_{ABC,t+1}^e)^1} + \frac{D_{ABC,t+2}^e}{(1 + i_{ABC,t+2}^e)^2} + \dots$$

or

$$P_{ABC,t} = \sum_{j=1}^{\infty} \frac{D_{ABC,t+j}^e}{(1 + i_{ABC,t+j}^e)^j}$$

► **Just as you should think**

- The present value of a flow or stream of future payments is just the sum of the individual present values.

► **One period vs. generalized model**

- The one-period model we started with and the generalized dividend model can be seen as two ways of saying the same thing, so long as ...
- When the  $P_{t+1}^e$  in the one-period model is equal to

$$\sum_{j=1}^{\infty} \frac{D_{t+j+1}^e}{(1 + i_{t+j+1}^e)^j}$$

the two models agree.

► **Stronger assumptions, more useful results!?**

- It is useful to make some additional assumptions to get some more useful results
- Q:Huh?
- A: To properly value a stock using the previous two approaches, we need to form expectations of dividends and choose appropriate discount rates, potentially into eternity
- Ch. 13 nicely reviews the difficulties here.
- These difficulties may explain why bubbles happen and why so many pundits make so much money pitching different views on value
- We'll explore two more models

► **Two models for gauging value**

► **Price-earnings ratios**

- Companies pay dividends out of earnings

Earnings are either paid out as dividends or 'retained' for future use by the firm

- Over time, stock prices tend to display a relatively stable relation with earnings
- I said relatively stable, not constant

For example, consider the price earnings ratio for all the stocks in the S&P 500

- This is the weighted average of all the 500 prices divided by the same weighted average of earnings per share.

► **Aside::**

- There are various ways of measuring the  $P/E$  ratio and, especially, for measuring the earnings part.
- I'll show Shiller's version.

► **Shiller S&P 500 Price Earnings Ratio**



- Data Cite  
go  
<http://www.multpl.com/>

► **A few facts re:the P/E figure**

- Mean: 16.72
- Median: 16.09
- Min: 4.78 (Dec 1920)
- Max: 44.19 (Dec 1999)

► **Interpretation**

- On average, stocks in the S&P sell for ‘a multiple’ of about 17 times earnings.
- But note that typical P/E ratios vary by industry, by national stock market, and by other features

► **Using P/E as guide to value**

- This is an identity:

$$P = \frac{P}{E} \times E$$

- But replace the  $\frac{P}{E}$  with the ‘normal’ P/E ratio and replace the  $E$  with an estimate of current earnings’ and you get a guide to a reasonable valuation
- Guide to value:

$$\text{approx. val.} = (\text{normal } P/E) \times (\text{current earnings})$$

► **Example**

- You think a normal  $P/E$  for some stock is about 17 and current earnings per share are \$2

The guide suggests a value of about \$34.

► **Interpreting this valuation benchmark**

- When price deviates from a guide like this, you ask ‘is there a good reason for the divergence?’
- Why might market price be high relative to this gauge  
Potential reason: Current earnings may be low relative to normal earnings. Some special factor is depressing current earnings but earnings will be higher in the future

► **Special cases**

- Consider a firm researching genetic drugs

Fabulously promising area. Maybe 10 years before anything marketable comes from the research.

- Never paid a dividend; never earned a dime.
- Still could be a very valuable firm, but P-E models won't help you assess a reasonable value.

► **The Gordon growth model**

► **Gordon growth model**

- The Gordon model pairs the generalized dividend model with some simplifying assumptions
- Suppose we are at time  $t$ , and dividend at time  $t$  is  $D_t$ .
- Assume that annual dividends grow at a constant rate,  $g$
- Dividends at time  $j$  are then

$$D_{t+j} = D_t(1 + g)^j$$

- Also assume that the appropriate discount rate for future payments is constant at  $k$
- Here I am using the textbooks notation:  $k$  is called the required rate of return.
- The infinite sum in the generalized dividend model becomes

$$P_t = \sum_{j=1}^{\infty} \frac{d_t(1 + g)^j}{(1 + k)^j}$$

- Following some algebra (text footnote 2 ch. 13):

$$P_t = \frac{d_t(1 + g)}{(k - g)}$$

► **Note:**

- Must assume ( $k > g$ ).

► **Example**

- Suppose a company is paying \$0.33 per share in dividends
- And the appropriate required return ( $k$ ) is 12 percent
- And you expect dividends to grow at 5 percent per year
- Using the formula, the Gordon model says value should be roughly:

$$PV = \frac{0.33(1.05)}{(0.12 - 0.05)} = \$4.58$$

► **Another use of this model**

- Suppose that the current price instead is \$9.50.

And you suspect that this is too much

- One way to assess this suspicion is to ask what dividend growth rate would be needed to justify the price.
- Write:

$$9.50 = \frac{0.33(1 + g)}{(0.12 - g)}$$

Solving gives  $g$  approx. 8.6 percent.

- Thus, you can consider whether dividends are likely to grow this fast.
- When the price earnings ratio was crazy high in 2000, this formula said that dividends would have to grow crazy fast in order to justify the price.

► **Right now?**

- How about right now!?!

P/E on S&P about 28

- Trump (Sept. 26) “We’re in a big, fat, ugly bubble” ; “going to come crashing down”  
go

<https://www.washingtonpost.com/news/the-fix/wp/2016/09/26/ldots-the-first-trump-clinton-presidential-debate-transcript-annotated/>

- BTW: S&P is up about 8 percent since then. . .

► **Limits of the model**

- This pricing model uses the assumption of a constant interest rate and dividend growth rate to the general present value formula
- These are very important simplifications.
- But the model can provide a useful benchmark for thinking about whether a stock price is reasonable

► **Overall comments on the models**

- The Gordon model and P/E valuation are basic rule of thumb approaches to checking whether a stock price seems reasonable

When something seems amiss, this is a signal to look for special factors that might explain the anomaly.



► **Bottom line on valuation**

- We've introduced some of the simplest models of stock valuation.
- Note, we didn't get into how you sensibly form expectations of future dividends from a company.
- Q: How do you suppose you do that?
- A: One way is to learn a lot about the company and the market it operates in and about overall economic conditions.

That's a lot of microeconomics, macroeconomics, managerial economics, and accounting.

- In other words, that pulls together all your classes
- In this class, we focus on the finance part: what do you do with those dividend expectations once you have them.

► **Finally,**

- We have also not really gotten into what determines the expected yield or the required rate of return.
- For that, we'll need portfolio theory, which is coming later.

► **Next time: how do markets actually match buyers and sellers, or . . .**

► . . .



What the etrade baby forgot to tell you