Stock valuation
266: Financial Markets and Institutions

Jon Faust

http://e105.org/e266

February 27, 2018

▶ Interesting times

- Trump (Sept. 26, 2016)

  "We're in a big, fat, ugly bubble" ; "going to come crashing down"

- Alan Greenspan (Jan. 31, 2018)

  "There are two bubbles: We have a stock market bubble, and we have a bond market bubble."

▶ Sources

- Trump

  go

  https://www.washingtonpost.com/news/the-fix/wp/2016/09/26/ldots

  the-first-trump-clinton-presidential-debate-transcript-annotated/

- Greenspan

  go

  https://www.marketwatch.com/story/alan-greenspan-says-there-are-two-bubbles-in-stocks-and-bonds-2018-01-31

▶ Equities

- We described what stocks are
- And some broad facts about stock market valuation
- We've also talked about bubbles and crashes

▶ Some deep and important questions

- Is there are 'correct,' or 'economically justified' value for stocks?
- If so, how do we know if stock prices are near their 'correct' values?
- Are stock prices almost always, or fairly generally, or rarely near 'correct' values?

▶ **Any good answers?**

- Experts don't agree on the answers to these questions, but they do agree on lots of elements that go into an answer.

  That is, into what forces should drive valuation

- We'll start into that material today

▶ **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 and future value of an asset are linked by an indentity involving an interest rate.

▶ **Present value**

- The present value, PV, of some claim that will be worth FV one year from now is:

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

  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
- Future value discounted at the interest rate i give the present value.
- If PV grows to FV over a year, the implied interest rate is i.
- If PV grows at the rate i for a year, it will equal FV.

▶ **Present value h years in future**

- We state interest rates at an annualized rate

  That is, interest rates are stated in the rate of change in value *per year*

- The 3 formulae given above are for the case when the future value is for 1 year in the future.
- If we want to refer to 2 years in the future or to 1/3 of a year in the future, we simple raise $(1+i)$ to the h power, where h is number of years

  and can be fractional.

▶ **Present value h years in future**

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

$$(1+i)^h = \frac{FV}{PV}$$

- Equivalently,

$$\begin{aligned} PV &= \frac{FV}{(1+i)^h} \\ FV &= PV(1+i)^h \\ 1+i &= \left(\frac{FV}{PV}\right)^{1/h} \end{aligned}$$

▶ **Aside:: h^{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:

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

- One year later, it will have grown by a factor of $(1+i)$ again, thus,

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

- 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.'

  These generally involve different conventions about compounding.

- 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

- I am mentioning this just to emphasize that financial markets work best when all terms are carefully defined.
- Unless otherwise noted, we will use the convention of annualizing by raising the the h^{th} power in this class.

▶ **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.
- Pesent value is future value divided by the apprpriate interest rate, so

$$P_{ABC,t} = \frac{P^e{}_{ABC,t+1} + D^e{}_{ABC,t+1}}{1 + i^e{}_{ABC,t+1}}$$

  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 fundament present value relation, we have

$$1 + i^e_{ABC,t} = \frac{D^e_{ABC,t+1} + P^e_{ABC,t+1}}{P_{ABC,t}}$$

One plus the expected return to 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 $D^e_{ABC,t+1}$ one year from now, $D^e_{ABC,t+2}$ 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, $D^e_1, D^e_2, \ldots$.
- The present value at time t is:

$$P_{ABC,t} = \frac{D^e_{ABC,t+1}}{(1 + i^e_{ABC,t+1})^1} + \frac{D^e_{ABC,t+2}}{(1 + i^e_{ABC,t+2})^2} + \ldots$$

or

$$P_{ABC,t} = \sum_{j=1}^{\infty} \frac{D^e_{ABC,t+j}}{(1 + i^e_{ABC,t+j})^j}$$

▶ **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.
- This is a version of what is called DCF—discounted cash flow—analysis.

The value of a future flow of payments is just the sum of the discounted present values of each of the payments.

▶ **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^e_{t+1} in the one-period model is equal to

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

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 the 'correct' value for an equity
- We'll explore two more models that are useful rules of thumb for assessing the proper value for a stock.

▶ **Two models for guaging 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

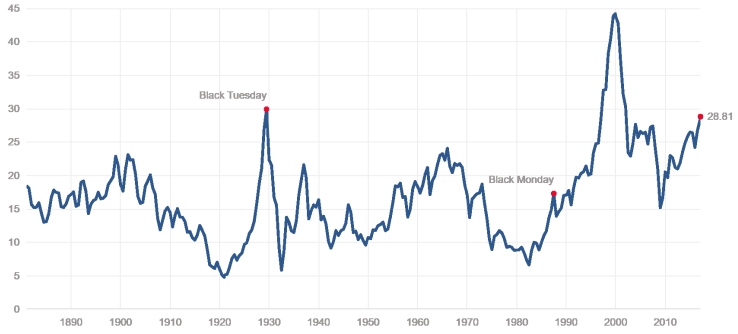
  For example, consider the price earnings ratio for all the stocks in the S&P 500

- 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/

- Trailing 12-month as reported earnings.

▶ **A few facts re:the P/E figure**

- Mean: 15.69
- Median: 14.69
- Min: 5.31 (Dec 1917)
- Max: 123.73 (May 2009)

▶ **Interpretation**

- On average, stocks in the S&P sell for 'a multiple' of about 16 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:

$$\begin{aligned} \text{approx. val.} &= \\ &(\quad \text{normal } P/E) \times (\text{current earnings}) \end{aligned}$$

▶ **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 guage

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 will be

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

- 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

▶ 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 alot 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 figured them out.

▶ **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...**