

Relative Valuation in Financial Markets

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1 Introduction to market valuation

Relative valuation: Using market information about comparable assets to estimate values.

Market prices contain information:

- How much one is willing to pay for an asset
- Equals the value that trader puts on the asset.

Theoretical basis: The law of one price: In a competitive market, if two assets are equivalent, they have the same price.

If not, market participants and arbitrageurs will immediately pounce on this, buy the relatively cheaper asset and sell the relatively more expensive asset. Since they are equivalent, the difference will go straight into the pocket of the arbitrageur.

Show an example of an arbitrage strategy.

Exercise 1.

You are given the following prices P_t today for receiving risk free payments t periods from now.

| | | | | |
|-------|---|------|-----|------|
| t | = | 1 | 2 | 3 |
| P_t | = | 0.95 | 0.9 | 0.95 |

There are traded securities that offer \$1 at any future date, available at these prices.

1. How would you make a lot of money?

Solution to Exercise 1.

1. This data implies an arbitrage opportunity. Note that the price of the risk free security offering \$1 in period 3 is higher than the price of the risk free security offering \$1 in period 2. What does this mean? It means you have to pay less today for receiving money sooner! To make a lot of money, short the risk free security for period 3, and use \$0.9 of the \$0.95 proceeds to buy the period 2 risk free security. The \$1 you get in period 2 can be kept as money and used to cover your obligation in period 3. For each of these transactions you get \$0.05 now. To get very rich, do a lot of these transactions.

Absence of arbitrage can be used to set prices in financial markets.

Example: Currencies. All priced from knowing currencies against dollar. If we want to translate NOK to GBP one will first convert the NOK to USD and then the USD to GBP.

1.1 Valuation using comparables

The law of one price leads to a simple way of doing valuation: Can we find assets which are comparable to those we want to value?

Example: Valuation of a house in Stavanger.

Ways to evaluate value:

1. Look at average of prices of “similar” houses transacted in last year.
2. Take price of the house when last it was transacted and adjust with an (time series) index for house prices (preferably in region).
3. Replacement value: How much would it cost to build a similar house today?

Exercise 2.

Sarah Fluggel is considering the purchase of a home located at 2121 Tarter Circle in Frisco, Texas. The home has 3,000 square feet of heated and cooled living area, and the current owners are asking a price of \$375,000 for it.

You have collected the following information about other house sales in the area

| | Comp # 1 | Comp # 2 |
|----------------------|-----------|-----------|
| Sale Price | \$240,000 | \$265,000 |
| Square footage | 2,240 | 2,145 |
| Selling price/sq.ft. | \$107.14 | \$123.54 |
| Time on the market | 61 days | 32 days |

- What is your initial estimate of the value of the home Sarah is considering?
- After making her initial estimate of the value of the home, Sarah decided to investigate whether the owner's asking price of \$375,000 might be justified based on unique attributes of the home. What types of details might you recommend Sarah look for trying to justify the price of the home?
- What if the house Sarah is considering had an asking price of \$315,000? What would you recommend Sarah do then?

Solution to Exercise 2.

The obvious way to estimate this is to multiply the square footage of the house Sarah is considering with an estimate of the typical price/square foot, which is the average of the two comparables, 115.34.

Multiplying this with the 3,000 square feet get an estimate of 346,020.

The asking price seems high relative to the comparables, don't buy

However, need to check that these houses *really* are comparable.

Obvious things to check

- Comparable upkeep/age of house

- Size/quality of garden/yard
- Neighborhood (noisy streets/neighbors)
- ...

Using the comparables, the asking price of 315,000 is lower than the value estimate, buy.

1.2 Pricing stocks using comparables

A simplistic valuation of stocks is the *P/E multiple method*:

Stock Price = Earnings per Share (EPS) × Industry average P/E multiple.

Let us first illustrate how this method works

Exercise 3.

We want to find the stock price of a firm in the software industry.

Currently, the P/E ratio for the industry is 24.

We are valuing a firm that projects earnings of 10 per share next year.

1. Estimate the value of one share.

Solution to Exercise 3.

Given a projected earning of say 10 NOK per share next year, we would predict that the price should be such that it matches the average P/E in the industry.

$$24 = \frac{P}{10}$$

$$P = 240$$

1.3 Theoretical justification of valuation using ratios

Exercise 4.

In valuation of companies one often uses the so called “P/E method” which says that the value can be found as an estimate of next year’s net earnings multiplied by a “P/E multiple”, ie

$$\text{Value}_t = E_t[X_{t+1}] \times \text{P/E multiple}$$

where X_{t+1} is the expected earnings of the firm. The “P/E multiple” is usually found by looking at industry averages.

1. How can such a procedure be reconciled with the standard stock valuation formula

$$P_t = \frac{E_t[D_{t+1}]}{r - g}?$$

2. Within this framework, is the application of industry standard “P/E factors” sensible?

Solution to Exercise 4.

1. Well, first lets transform the per stock number to firm value by multiplying with the number of shares outstanding, lets call it n_t :

$$\text{Value}_t = n_t P_t = \frac{n_t E_t[D_{t+1}]}{r - g}$$

If the firm pays out all earnings as dividends, total dividend payout ($n \times D$) equals earnings (X).

$$n_t E_t[D_{t+1}] = E_t[X_{t+1}]$$

and we can write

$$\text{Value}_t = \frac{E[X_{t+1}]}{r - g}$$

rewrite as:

$$\text{Value}_t = E[X_{t+1}] \left(\frac{1}{r-g} \right)$$

Here it is clear that if we let the “P/E multiple” equal $\left(\frac{1}{r-g} \right)$, the two formulas are consistent.

2. Is it sensible to apply an industry standard “P/E multiple”?

Well, within this context what this amounts to is assuming that $\left(\frac{1}{r-g} \right)$ is constant across firms in the same industry. Now, both r and g are company specific, but they are likely to be similar across firms in the same industry, so to a rough approximation it may be ok.

2 ExxonMobil Chemical Division

ExxonMobil is a large energy company, with oil production its main line of business.¹ From the 2004 annual report, you can find the earnings for the whole company, and also broken down on its divisions²

| | |
|----------------------|--------------|
| Net Income for Exxon | 25.3 billion |
| Earnings in | |
| Upstream | 16.7 billion |
| Downstream | 5.7 billion |
| Chemical Division | 3.4 billion |

The Chemical division is large, but a small piece of the company, and one could envision ExxonMobile divesting (splitting it off as a separate company through an IPO), or selling it.

What would be a reasonable estimate for the price of the Chemical Division.

Since we have the earnings for the chemical division, can estimate the value using the *Price/Earnings* ratio of comparable companies.

Chemical Company Price/Earnings Ratios (August 16, 2005)

| | Share Price | / | EPS | = | P/E Ratio |
|------------------------|-------------|---|---------|---|-----------|
| BASF AG (BF) | 70.47 | | 4.243 | | 13.44 |
| Bayer AG (BAY) | 35.64 | | 1.511 | | 23.59 |
| Dow Chemical (DOW) | 47.40 | | 4.401 | | 10.77 |
| E I DuPont (DD) | 41.00 | | 2.572 | | 15.94 |
| Eastman Chemical (EMN) | 51.69 | | 5.75 | | 8.99 |
| FMC (FMC) | 59.52 | | 5.729 | | 10.39 |
| Rohm & Hass (ROH) | 45.02 | | 2.678 | | 16.81 |
| | | | Average | | 14.28 |

Based on this average, value of chemical division is $14.28 * \text{Earnings} = 14.28 * 3.4 \text{ bill} = 48.552 \text{ billion}$

Is this really the best estimate?

How comparable are the comparables?

Typical issue: Firm size.

¹This example builds on (Titman and Martin, 2016, Ch 8).

²This type of breakdown of earnings on divisions is not common, making it harder to do this kind of exercises “from the outside”.

| | P/E Ratio | Market Cap (bill) |
|------------------------|-----------|-------------------|
| BASF AG (BF) | 13.44 | 38.25 |
| Bayer AG (BAY) | 23.59 | 25.63 |
| Dow Chemical (DOW) | 10.77 | 45.25 |
| E I DuPont (DD) | 15.94 | 40.61 |
| Eastman Chemical (EMN) | 8.99 | 4.10 |
| FMC (FMC) | 10.39 | 2.20 |
| Rohm & Hass (ROH) | 16.81 | 10.01 |
| Average all | 14.28 | |
| Average big 4 | 15.94 | |
| Average small 3 | 12.06 | |

Want comparable size, so the big 4 may be a better set of comparables.

With that choice, would estimate value of Chemical division as $15.94 * 3.4 \text{ bill} = 54.2 \text{ bill}$

Issue: Do they have comparable leverage?

Check annual reports for 2004, some selected observations.

| | Debt/Value | Debt/Equity |
|------------------------|-------------|-------------|
| Exxon | ≈ 0 | |
| BASF AG (BF) | 17% | |
| Bayer AG (BAY) | | 2.43 |
| Dow Chemical (DOW) | 39% | |
| E I DuPont (DD) | 14% | |
| Eastman Chemical (EMN) | | |
| FMC (FMC) | | |
| Rohm & Hass (ROH) | | |

Note that Bayer in particular has very high indebtedness. Could consider removing that from the top four, taking average of BASF, Dow and DuPont, which is a P/E ratio of 13.83.³

With that choice, would estimate value of Chemical division as $13.83 * 3.4 \text{ bill} = 47.0 \text{ bill}$

Another issue: Which earnings to use?

Market prices should reflect *expectations* of future earnings.

Do those expectations differ from the last observed earnings (from the most recent accounts)?

If they do, consider using *analysts forecasts* of earnings instead of the recent accounts. This is typically called the *forward* P/E ratio.

| | Share Price | Current EPS | Current/Trailing P/E Ratio | Forecast EPS | Forward P/E Ratio |
|------------------------|-------------|-------------|----------------------------|--------------|-------------------|
| BASF AG (BF) | 70.47 | 4.243 | 13.44 | 7.27 | 9.69 |
| Bayer AG (BAY) | 35.64 | 1.511 | 23.59 | 2.69 | 13.27 |
| Dow Chemical (DOW) | 47.40 | 4.401 | 10.77 | 5.71 | 8.30 |
| E I DuPont (DD) | 41.00 | 2.572 | 15.94 | 3.04 | 13.84 |
| Eastman Chemical (EMN) | 51.69 | 5.75 | 8.99 | 5.93 | 8.71 |
| FMC (FMC) | 59.52 | 5.729 | 10.39 | 5.66 | 10.51 |
| Rohm & Hass (ROH) | 45.02 | 2.678 | 16.81 | 3.12 | 14.44 |
| Average | | | 14.28 | | 11.20 |

With that choice, would estimate value of Chemical division as $11.20 * 3.4 \text{ bill} = 38.1 \text{ bill}$

Under different assumptions, different estimates of the value of the Chemical Division

³Alternatively, consider estimating value of company, instead of just equity.

Average all comparables 48.6 bill
 Average big four 54.2 bill
 Large companies with reasonably similar D/E 47.0 bill
 Forward P/E 38.1 bill

Finally, tackle the problem that the comparable companies really are not that comparable, as they have different D/E ratios.

Really a case for instead working with a ratio involving the company value instead. Go to the annual reports of these four companies, get the 2004 values of stock prices, long term debt and earnings.

| | Debt/ Value | Share Price | Number Shares | Long term debt | Earnings | Company value | Value/ Earnings |
|--------------|----------------|----------------|------------------|----------------------|----------|------------------|--------------------|
| EXXON | ≈ zero | | 6401 | | | | |
| BASF | 17.00% | 72 | 541 | 6391 | 4856 | 45360 | 9.3 |
| Bayer | 70.85% | 23.3 | 730 | 13646 | 4130 | 30684 | 7.4 |
| Dow Chem | 39.00% | 47.4 | 940 | 11629 | 2797 | 56189 | 20.1 |
| E I DuPont | 14.00% | 41.1 | 998 | 5548 | 2053 | 46466 | 22.6 |
| Eastman Chem | | 51.7 | | | | | |
| FMC | | 59.5 | | | | | |
| Rohm & Hass | | 45.0 | | | | | |
| Average | | | | | | | 14.87 |

Note that the numbers for BASF and Bayer are in €
 Average Value/Earnings: 14.87.

With that number, since Exxon essentially has no debt, will estimate the value of Exxon's chemical division as

$$14.87 * 3.4 \text{ bill} = 50.558 \text{ bill}$$

3 Company Valuation by multiples

(or – relative valuation)

Relative valuation - value assets based on how similar assets are currently priced in the market.

Easy to use (and misuse)

Two components:

1. To value assets relatively, must be standardized (multiples of earnings/book values/sales)
2. Find similar firms

Use of relative valuation – widespread

Why so popular?

1. Can be done quickly, with few assumptions
2. simple to understand and present
3. more likely reflect current mood in the market

Potential pitfalls

1. Simplicity lets on apply the method inconsistently, ignoring important differences between ratios/firms
2. Reflecting the market mood not necessarily correct (irrational exuberance)

3.1 Sequencing of analysis

Using market multiples to estimate the value of a business.

Example: Buy house/car - what are prices of similar houses/cars. How comparable are the transactions.

Car: Make, year, mileage... House: Location, size,

Often used term: "Market approach" to distinguish from Discounted Cash Flow valuation

Three part process

1. Search and select
2. Adjust and compute
3. Apply and conclude

3.2 Search and select

Selection of group of comparable companies:

Matching by business attributes, e.g.

- industry SIC/GICS code
- size
- geographical location

Selection of multiples to calculate
Relevance for particular company?

Standard:

- Value/Revenue
- Value/EBIT
- Value/EBITDA

Industry specialties

- Value/Building size
- Value/Subscriber base

Enterprise value divided by

- EBIT
- EBITDA
- Sales
- Gross profit
- Total assets
- Net fixed assets

Market Capitalization divided by

- Net Income
- Dividends

- Net Cash Flow

- Earnings before taxes
- Assets less liabilities

Stock Price divided by

- Earnings per share
- Dividends per share
- Cash flow per share
- Book value per share

Industry-specific multiples

- Cable TV: MVIC/subscribers
- Retailers: MVIC/square foot

- | | |
|---|---|
| <ul style="list-style-type: none"> • HMOs: MVIC/covered members • Bottlers: MVIC/case | <ul style="list-style-type: none"> • Technology: MVIC/patents • Technology: MVIC/scientists |
|---|---|

Source: HBS note on Corporate Valuation and Market Multiples.

Equity value or enterprise value?

Need for consistency

If enterprise value, numbers for firm.

If equity: Stock prices – market cap, Income figures after interest, after tax

How large a sample? The larger the better (statistical power)

3.3 Adjust and compute

- Estimate enterprise value:
 - Market values of debt and equity and other hybrid securities may need to settle for book values of debt
 - Calculate values of hybrid securities, convertible debt, warrants, etc, may need to use option pricing methods to set value.
- Operating metrics (EBIT, EBITDA, etc) for comparable companies
 - May need to adjust to obtain comparable metrics
 - LIFO/FIFO accounting
 - nonrecurring items
 - nonoperating items
 - See more complete list below
 - * Inventory accounting (e.g. LIFO vs FIFO)
 - * Extraordinary items (e.g. litigation settlements)
 - * Non-recurring items (e.g. discontinued operations, asset sales)
 - * Owner's compensation
 - * Capitalization of intangibles (from prior acquisitions)
 - * non-operating assets
 - * construction in progress
 - * NOL carryforwards
 - * Special tax items
 - * Treatment of leases (operating vs. capital)

Source: HBS note on Corporate Valuation and Market Multiples.

- Trailing basis: last 12 months, for example

3.4 Apply and conclude

- Ensure consistency of basis in subject company.
- Calculate.

Evaluate:

- Applicability
- Liquidity differences.

3.5 Practical issues

- Sample size – small samples – lower confidence
- Seasonality?
- Leverage.

Safest to calculate enterprise value and then subtract value of debt to estimate equity values.

Problem: Equity multiples sensitive to leverage. Need to “unlever” ratios to make them comparable across companies, similar to unlevering of beta.

- Unreliable market data?
- Regression/Factor analysis.

May be better to use several ratios, estimate relationship between value and the different ratios by regressions/factor analysis.

However, only as good as the data

Exercise 5.

Value the equity of a non-listed company with earnings \$2.3 mill, using the following set of comparable companies.

| | Earnings per share | Stock price | PE |
|--------|-----------------------|----------------|------|
| Firm A | \$1.00 | \$10 | 10.0 |
| Firm B | \$1.50 | \$14 | 9.3 |
| Firm C | \$1.25 | \$13 | 10.4 |

Solution to Exercise 5.

$$\text{Average PE ratio} = 9.91$$

$$\text{Value of equity} = 2.3 \text{ mill} \times \text{industry avg PE ratio} = 9.91 \times 2.3 = \$22.8 \text{ mill}$$

Exercise 6.

You want to value company C, and find two comparable firms A and B.

| Firm | Debt | Equity | Sales | Earnings | PS | PE |
|---------|------|--------|-------|----------|-----|-------|
| A | 600 | 600 | 200 | 51 | 3 | 11.76 |
| B | 0 | 1200 | 200 | 100 | 6 | 12.00 |
| Average | | | | | 4.5 | 11.88 |
| C | 300 | 300 | 100 | 25 | 3 | 12.0 |

1. Value C using PS
2. Value C using PE

Solution to Exercise 6.

- Average PS multiple: $4.5 \times 100 = 450$
- Average PE ratio: $11.88 \times 25 = 297$

4 Summarizing

Key message: Prices in financial markets convey information.

One need more information than public information to say that market prices are incorrect.

Law of one price: “Same Cashflows = Same value”

Implication of law of one price: Valuation can be done by looking at comparable assets.

5 Readings

Textbook discussions in (Titman and Martin, 2016, Ch 8) and (Berk and DeMarzo, 2020, Ch 19)

References

Jonathan Berk and Peter DeMarzo. *Corporate Finance*. Pearson, fifth edition, 2020.

Sheridan Titman and John D Martin. *Valuation. The art and science of corporate investment decisions*. Pearson, third edition, 2016.