Bachelor thesis tutorial

Financial Ratios

Ernst Maug
University of Mannheim
http://cf.bwl.uni-mannheim.de
maug@uni-mannheim.de
Tel: +49 (621) 181-1951

UNIVERSITÄT MANNHEIM
EFMD EQUIS ACCREDITED
Accredited by Association of MBAs

Valuation with multiples

- Many practitioners use multiples to value companies.
- Example: Price-Earnings ratio (P/E)
- Procedure:
  - Select set of comparable companies
  - Compute average P/E-ratio of comparables
  - Multiply earnings of company to be valued with average P/E of comparables
  - Done!
- Advantages: easy, no estimation of value drivers
- Problems: lots!

Popular multiples used for valuation

- Ratios for firm value (= debt + equity):
  - Value-to-sales ratio
  - Value-to-cash-flow ratio
  - Value-to-EBIT ratio
  - Value-to-EBITDA ratio
  - Market-to-book ratio (value over total assets)
  - Tobin's q (market value over replacement value)
- Ratios for equity value:
  - P/E ratio (price over net income)
  - Market-to-book ratio (price over book value of equity)
- Numerator and denominator should match!

Valuing a Company Using P/E-Multiples

- The three steps of using P/E multiples company valuation:
  1. Find sample of comparable companies
  2. Compute average of their P/E ratios
  3. Multiply earnings by average P/E from step 2
- *Example:* Daimler
  - Comparables: BMW, VW, Toyota, Renault, Fiat, (PSA)

Averaging method	Average	Value	Error
Mean	25.48	163.04 €	165%
Median	10.74	68.71 €	12%
Harmonic mean	12.57	80.44 €	31%
Geometric mean	15.85	101.43 €	65%
Actual values Daimler	9.61	61.53 €	0%

For calculations see *Financial Ratios – Multiples.xls*, tab "Valuation".

Lessons for the selection of comparables

- Multiples valuation avoids the estimation of cash flows, sales forecasts, margins, growth rates, payout ratios.
- Instead uses market assessment of all valuations combined
- Implicit assumption: comparable companies have:
  - Similar growth rates
  - Similar stage (fast growth / slow growth)
  - Similar margins
  - Similar cost of capital or cost of equity (leverage!)
  - Similar payout ratios

Popular financial ratios used for valuation

- Which numbers are used?
  - Always: current market prices in the numerator
  - For **trailing ratios**, use the latest historical number in the denominator.
  - For **leading ratios**, use analysts' forecasts in the denominator.
- Some ratios are heavily influenced by accounting choices:
  - P/E ratio, EBIT ratio, EBITDA ratio
  - To get around this problem:
    - Re-adjust earnings for special items
    - Use ratios based on financial numbers "further up in the income statement", e.g. value-to-sales ratio.

Empirical evidence:
Which ratios are successful?

- Liu, Nissim and Thomas (Journal of Accounting Research, 2002) perform a horse-race of different ratios:
  - For each firm, they use all firms from the same industry as comparables and calculate the average multiple.
  - Then they multiply this average multiple with the corresponding accounting number of the firm to be valued.
  - Finally, they compare the obtained value estimate with the firm's market capitalization.

- Their findings are:
  - Multiples derived from earnings *forecasts* have the lowest pricing errors.
  - Multiples with historical earnings come second.
  - Cash flow and book value of equity are tied for third.
  - Sales perform worst.

- Repeated for
  - 26,613 firm-year observations between 1982 and 1999
  - for 19 different types of multiples.
  - Measure of accuracy: Absolute difference between estimated value and market value
- Their findings are:
  - Multiples derived from earnings *forecasts* have the lowest pricing errors.
  - Multiples with historical earnings come second.
  - Cash flow and book value of equity are tied for third.
  - Sales perform worst.

Empirical evidence:
Which ratios are successful?

- Other finding: Harmonic mean results in lower errors than arithmetic mean or median.
  - Harmonic mean:

$$m_h = n\left[\sum_{i=1}^{n}(x_i)^{-1}\right]^{-1}$$

  - Arithmetic mean:

$$m_a = \frac{1}{n}\sum_{i=1}^{n}x_i$$

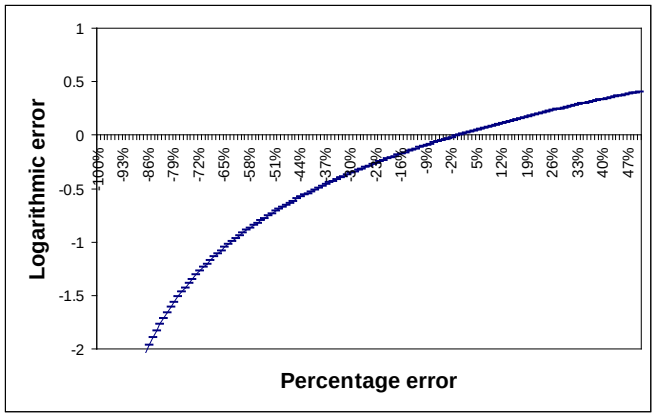
  - These results are consistent across years and industries.

- Dittmann, Maug (WP 2005) also include median and geometric mean:

$$m_g = \prod_{i=1}^{i=n} x_i^{1/n} = \exp\left\{\frac{1}{n}\sum_{i=1}^{i=n} \ln x_i\right\} = \exp\left\{m_a\left(\ln x_i\right)\right\}$$

- Analyze percentage errors and log errors:

$$e_P = \frac{\hat{MV}_i - MV_i}{MV_i}, e_{\log} = \ln\frac{\hat{MV}_i}{MV_i}$$



- Benchmark against „dummy procedures“:
  - Set market value = book value, or equal to $1

Empirical evidence (2):

- Results of empirical analysis and simulations of Dittmann, Maug (WP 2005):
  - Harmonic mean is biased downward, about as much as arithmetic mean is biased upward.
  - Geometric mean and median are both good.

Conclusion

- Multiples provide a short-cut.
- Rely on comparability:
  - Companies from the same industry
  - Really companies with similar value drivers!
- Averaging methods matter!
- Recommended reading: Titman and Martin, Valuation: the Art and Science of Corporate Investment Decisions, Chapter 6.