MULTIPERIOD HISTORICAL ROE AND IRR

1. Overview

One evaluates whether forecasts are reasonable by comparing them to the track record. The spreadsheet develops two summary measures of past performance – multiperiod ROE and IRR that can be used to gauge the reasonableness of forecasted ROE and IRR. The spreadsheet does the following:

- Compute a multiperiod ROE measure that is much less sensitive to accounting idiosyncrasies (such as non-recurring items), accounting manipulations, and upward biases arising from accounting conservatism as compared to the single-year ROE.
- To complement the multiperiod ROE, the spreadsheet also derives IRR. IRR presumes that a firm's book values at the beginning and end of the period can serve as surrogates for "investment" and "liquidation" values. IRR should be close to the multiperiod ROE, and if not, one must investigate the reasons for the difference.

ROE is a commonly used measure of a firm's annual performance. However, for a period as short as a year, the numerator of ROE is sensitive to non-recurring items. The denominator of ROE can also be biased downwards due to conservatism. A measure that smoothes earnings over several years and partially cancels out the biases in the beginning and the ending balance sheets is therefore preferred.

Measuring ROE over multiple periods is straightforward if there are no dividends. Let b_0 denote the current book value of common shareholders equity, and let b_{-T} denote the book value T years ago. With no dividends, the change in book value equals the total earnings over the T years. The annualized, composite ROE equals $\{(b_0/b_{-T}\}^{1/T}$ -1), which is the geometric average annual growth rate in book value.

In case of dividends, one generalizes the above geometric growth of book value concept by estimating what the book value would have been had there been no dividends. This hypothetical scenario leads to two distinct adjustments. First, all past dividends must be added to the current book value. Second, one has to estimate the earnings that have been foregone due to the dividends. This can be done by assuming the dividends had earned a cost of capital rate. Hence the calculations lead to the hypothetical current book value, h_0 = sum of past dividends + earnings foregone due to past dividends. The geometric mean ROE now equals $((h_0/b_{-T})^{1/T}$ - 1). Alternatively, h_0 also equals b_{-T} + sum of past earnings + earnings foregone due to past dividends.

The multiperiod historical ROE is an important baseline. Any differences between forecasted ROE and multiperiod historical ROE need to be explained in terms of changes in the enterprise value drivers (enterprise profit margin and net enterprise asset turnover) or its financial policy.

2. The analytics of dividend adjusted, geometric average ROE

Current year = Y_0. Previous year= Y_{-1}, and so on.

E_0 = Sum of earnings per share over the current year and previous five years

Assume that all dividends are paid at the end of the year. One could use quarterly data for accuracy.

d_{-5} = dividends per share paid at the end of Year -5, and so on.

$D_0 = \Sigma\, d_{-n}$ = sum of dividends per share over current and previous five years

r_e = cost of equity. This is the yield assumed to be earned on dividends had they been reinvested.

F_0 = Sum of earnings foregone on dividends paid over previous five years

$$= \Sigma\, d_{-n}(1+r)^n - \Sigma\, d_{-n} = d_{-5}(1+r_e)^5 - d_{-5} + d_{-4}(1+r_e)^4 - d_{-4} + d_{-3}(1+r_e)^3 - d_{-3} + d_{-2}(1+r_e)^2 - d_{-2} + d_{-1}(1+r_e)^1 - d_1$$

b_{-6} = Book value at the at the end of Y_{-6} or at the beginning of Y_{-5}

h_0 = Hypothetical book value at the end of Y_0 assuming investment of dividends had yielded cost of equity r_e

$h_0 = b_{-6} + E_0 + F_0$

Alternatively, $h_0 = b_0 + \Sigma\, d_{-n} + F_0$.

r = annualized rate of return over the six years including the current year = $(h_0/b_{-6})^{(1/6)} - 1$

It can be shown that this formula is relatively insensitive to accounting policies.

In the absence of biases due to conservatism, the benchmark return is r_e. The firm earns superior returns if and only if r exceeds r_e.

Because of accounting conservatism, in general one should expect ROE to exceed the r_e. In that case, IRR exceeds ROE. (As a special case, IRR=ROE if and only if ROE equals r_e.)

2.1. A comparison: Internal rate of return

To distinguish multiperiod ROE from an internal rate of return, we compute a hypothetical IRR as the rate of return r that solves the following equation:

$$b_{-6} = + d_{-5}/(1+r)^1 + d_{-4}/(1+r)^2 + d_{-3}/(1+r)^3 + d_{-2}/(1+r)^4 + d_{-1}/(1+r)^5 + (b_0+d_0)/(1+r)^6$$

That is, the internal rate of return is computed as if the firm was purchased for b_{-6} at the end of Y_{-6}. The holder then received the dividends over the next six years and sold the investment for b_0.

IRR differs from ROE because the IRR computation assumes that the dividends are reinvested at IRR while the ROE computation assumes that the dividends are reinvested at the cost of equity.

Conservative accounting exerts a downward bias on both b_{-6} and b_0. These two biases offset each other, thereby lowering the susceptibility of IRR to accounting rules.

2.2. Advanced: Computing Return On Market Equity (ROME) by replacing book value with stock price

One can replace the current book value with the current market value, but otherwise keep all inputs and ROE and IRR computations the same. The so redefined ROE can be thought of as Return on Market Equity (ROME). In a one-period setting, ROME is simply the trailing earnings yield or the inverse of the trailing PE ratio. Our multi-year computation of ROME reduces the sensitivity of ROME to timing issues.

ROME is driven by measurement issues, risk, growth, or mispricing. We do not deal with measurement issues here. To adjust for risk, ROME is compared to cost of equity. If ROME exceeds cost of equity, then, the excess may reflect negative growth outlook or an underpriced stock, and deciding which one applies requires judgment and further analysis.

3. Enterprise-level or unlevered analysis

The second spreadsheet shifts the analysis to enterprise activities to derive unlevered ratios and highlight the role of enterprise cash flows (ECF). The analysis also shifts from a per share basis to a total dollar basis because the number of shares outstanding depends on the financial policy.

Equity-level or levered analysis	Enterprise-level or unlevered analysis
Book value of equity per share	Net enterprise assets [NEA]
Dividends per share	Enterprise dividends or enterprise free cash flows [ECF]
Earnings per share	Enterprise profit after tax [EPAT]
ROE	Return on invested capital [ROIC] or return on NEA [RNEA]
Equity or levered IRR	Enterprise or unlevered IRR

The spreadsheet also compares growth in NEA to growth in sales. This metric is central: if the growth in sales is less than the growth in NEA, then the firm has experienced a decline in its investment efficiency. This suggests the profit margin will decline in the future.

4. Detailed steps to be read with the spreadsheet

The numbers below are assumed to be on a per share basis. One can also use total dollar amounts as long as one changes dividends per share to dividends net of capital contributions.

4.1. Intermediate computations

4.1.1. Earnings

1. Input: Earnings per share e_{-n} for the current year and previous five years. The EPS numbers should include all non-recurring items (such as gains/losses due to discontinued operations). Conservatism also suggests that the diluted EPS are preferable to basic EPS.

    1.1. The spreadsheet refers to data on a per share basis. This approach is the simplest one because EPS and DPS histories on a comparable per share basis are readily available. The spreadsheet works equally well on a total dollar basis. In that case, one derives the net dividends via the equation, net dividend = comprehensive earnings - change in equity.

2. Refer to the input for earnings per share.

3. Sum these earnings over six years: E_0

4.1.2. Dividends

4. Input: Dividends per share d_{-n} for the current year and previous five years

5. Refer to the input for dividends per share

6. Sum these dividends over six years: D_0

4.1.3. Reconstructed historical book values

7. Input: Current book value is given.

8. Infer book values b_{-n} at the end of each prior year. $b_{-n} = b_{-n+1} – (e_{-n+1} - d_{-n+1})$

4.1.4. Cost of equity: Hypothetical earnings rate on dividends

9. Input: Cost of equity r_e. This is the yield assumed to be obtainable on dividends had they been reinvested.

4.1.5. Hypothetical earnings foregone because of dividends paid out

10. Compounding factor for dividends at the end of year-n is $(1+r_e)^n$. One could use quarterly data for earnings and dividends if more accuracy is desired.

11. Compound each year's dividend to the end of the current year by multiplying by the compounding factor.

12. Subtract the original dividend to compute what could have been earned on those dividends at r_e.

13. Sum these foregone earnings: F_0

4.2. Multiperiod return on common equity

14. Numerator: Sum actual and foregone earnings over six years: E_0+F_0

15. Denominator: Book value at the end of Y_{-6}

16. Total return over $b_{-6} = (E_0 + F_0)/ b_{-6}$
17. Annualized return = $(1 + \text{total return})^{1/6} - 1$.

4.2.1. Alternate computation of multiperiod ROE

18. h_0 = Hypothetical book value at the end of $Y_0 = b_{-6} + E_0 + F_0$
19. Sum of dividends and earnings foregone: $D_0 + F_0$
20. Alternate computation: $h_0 = b_0 + D_0 + F_0$
21. Annualized return over six years $r = (H_0/b_{-6})^{1/6} - 1$

4.3. IRR computation

22. Assume that an investor purchased the firm by paying b_{-6} at the end of Y_{-6}.
23. The investor receives dividends each year.
24. The investor sells the firm for b_0 at the end of Y_0.
25. Hypothetical cash flows = Sum of the above three items
26. Use the Excel IRR function to compute the internal rate of return.