Cost of equity

General introduction to cost of equity estimates on SBF 120
constituents available from the Valphi web site

The Valphi web site provides free access to monthly estimates for the cost of equity of the constituents of the French equity index SBF 120, the index itself and the French blue chip index CAC 40 (which constituents also belong to SBF 120).

Cost of equity estimates are based on the following formula:

$$r = \frac{1}{P/E} + g \times \left(1 - \frac{1}{PtB}\right)$$

where P/E and PtB are respectively the price-earnings ratio and the price-to-book ratio with g the nominal long term growth rate for the company's revenues and earnings. Stock multiples are based on the latest closing stock price available at the last update. To even out economic cycle effects, net earnings and book values used in the denominator are averaged over various periods of time.

Different period choices for average calculations provide different series for cost of equity estimates. Indices estimates thus obtained as average or median of individual constituents cost of equity can be considered as the market return input of the CAPM model to derive in turn companies' cost of equity estimates per $r = r_f + \beta \times (r_m - r_f)$*. In addition to companies' cost of equity estimates based on their last stock price and P/E and PtB multiples, we provide series of estimates obtained through such indirect method, based on various historical betas measures.*

This note discusses the origin of the formula used to estimate cost of equity based on long term growth and earnings and book value stock multiples.

Definition of parameters and key to fields in table columns are provided in the appendix of this note and are also accessible directly from the table, through the tooltip under the Valphi logo. Historical monthly series from 2004 onwards of cost of equity estimates for SBF 120 and CAC 40 indices are also available for download in Excel form.

I. General calculation

The cost of equity is the return yield expected from an investment in the share capital of a company. As such, no measure of cost of equity can be obtained directly from market observations but there are several ways to derive more or less robust estimates.

The most common calculation is based on the Sharpe model: $r = r_f + \beta \times (r_m - r_f)$ where r_f is the risk free yield, r_m the market return and β the beta coefficient, i.e. a statistical measure of the security market risk. Beyond legitimate questions on the validity of the model hypotheses (such as the existence of a single market portfolio, the "risk-free" rate available for investment as well as borrowings, the separation theorem, the absence of transaction costs and the market efficiency hypotheses), practical use requires to estimate a market risk premium for all stock investments $(r_m - r_f)$ and such equity premium assessment is not trivial.

References to past returns on stock market often prove inconclusive as results vary widely depending on geography, historical period and return calculation method (geometric or arithmetic average for instance).

An alternative option is to assess directly the equity premium from the latest stock prices, assuming they reflect all market information available.

Under the market efficiency hypothesis, the market value of a company is equal to the sum of its future cash flows discounted at the cost of equity. Such equality can be expressed in the form of an equation ($V_m = \sum_{k=0}^{\infty} \frac{f_{t_k}}{(1+r)^k}$) which unknown factor is the discount rate r and which can be solved assuming a complete set of hypotheses is available to define future cash flows f_{t_k} and considering that the company's market value V_m is its market capitalization.

In this equation, the discount rate that equalizes the present value of future cash flows and the market capitalization is the current expected return on an investment in the share capital of the company, i.e. the cost of equity, based on the latest stock price and the defined set of hypotheses for company's future cash flows.

Assuming the expected return on the market portfolio can be approximated by the expected return on a sufficiently large and diversified equity index, it can then be assessed as the weighted average of all index constituents' expected returns, based on each company's weight in the index. An estimate of the equity risk premium $(r_m - r_f)$ can thus be derived from such index expected return (r_m) by subtracting a sovereign bond yield (« risk free» r_f), such estimate depending upon market observations (stock prices and set of hypotheses on future cash flows), equity index choice (e.g. CAC 40) and the reference sovereign bond yield (e.g. French 10-y OAT).

II. Particular cases and simplified formula

The equation expressing the equality between market capitalization and discounted future cash flows ($V_m = \sum_{k=0}^{\infty} \frac{f_{t_k}}{(1+r)^k}$) can be more easily solved assuming simplified hypotheses for future cash flows.

For instance, assuming each flow f_{t_k} is a dividend growing at a constant rate g (i.e. $f_{t_k} = Div \times (1+g)^{k-1}$), the equation can be simplified in:

$$V_m = \frac{Div}{r-g}$$

i.e.:

$$r = \frac{Div}{V_m} + g = Div.yield + g \qquad (1)$$

Relation (1) expresses the identity between the expected rate of return on an equity investment and the dividend yield plus the nominal long term growth rate of such dividend.

Relation (1) reminds us that the return offered to the equity investor will take the form of a dividend, whether such dividend is paid immediately or deferred and accrued depending on the company's financing needs.

In practice, historical dividends – on CAC 40 constituents for instance – are constrained by external growth financing. Out of relation (1), no significant result can thus be obtained beyond an order of magnitude –in likelihood understated – of the cost of equity for each company, of limited use to differentiate securities on expected returns. It underlines though the importance of the dividend – the revenue of the shareholder – which offers the primary key to assess expected returns.

In relation (1) $V_m = \frac{Div}{r-g}$, the dividend term can be changed using $Div = NI - \Delta BV$ (where NI is the net income and BV the book value of the equity). Factoring BV, the dividend expression becomes: $Div = BV \times \left(\frac{NI}{BV} - \frac{\Delta BV}{BV}\right) = BV \times (ROE - g)$, which can be replaced in (1) to get:

$$\frac{V_m}{BV} = \frac{ROE - g}{r - g} \qquad (2)$$

The ratio $\frac{V_m}{BV}$ is the *Price to Book* (PtB). Return on equity $ROE = \frac{NI}{BV} = \frac{NI}{V_m} \times \frac{V_m}{BV} = \frac{1}{P/E} \times PtB$ and therefore relation (2) can be expressed as $PtB = PtB \times \left(\frac{\frac{1}{P/E} - \frac{g}{PtB}}{r-g} \right)$, and finally:

$r - g = \frac{1}{PER} - \frac{g}{PtB}$, i.e.

$$r = \frac{1}{P/E} + g \times \left(1 - \frac{1}{PtB}\right) \quad (3)$$

III. Interpretation

In relation (1) as in relation (3), the cost of equity is expressed as the addition of a yield term (dividend yield or P/E inverse) and a growth term (the growth rate g directly or reduced by the Price to Book inverse).

Between relations (1) and (3), the yield basis for the equity investor has changed from dividend to net income. The net revenue of the investor in the end is actually the *net income*, whether paid out in the form of dividend or contributing to potential future capital gain when dividends are partially or totally reinvested.

By making part of its income directly available to the company through retained earnings, the investor partially defers its revenue to contribute to growth financing, all the more important in high growth situations. The return expected by the investor is not only the dividend yield but also the deferred return attached to growth financing as expressed in relation (1).

Conversely, in relation (3), the revenue yield is calculated directly from net income and not from the dividend. In this case, the investor may not expect any additional return, except in specific situations, when its contribution to growth financing benefit from favorable market conditions, i.e. with a Price to Book ratio in excess of 1.

Indeed, to the extent euros invested in the assets of the company benefit from PtB multiples higher than 1 on the stock market, investment expressed as a fraction of the company book value $f_1 = \frac{I}{BV}$ shall be associated with a reduced fraction of the market value: $f_2 = \frac{I}{V_m} = \frac{I}{BV} \times \frac{BV}{V_m} = \frac{f_1}{PtB}$, in a ratio inverse to the *Price to Book*.

With a *Price to Book* of 3 for instance, a 15% increase in the book value of the company translates into a 15%/3 =5% increase of its market capitalization. Assuming unchanged return on capital invested (i.e. if net income increases as per book value, i.e. by 15%), post investment ratios are:

$$\frac{NI'}{I'} = \frac{NI \times (1 + 15\%)}{I \times (1 + \frac{15\%}{3})} \approx \frac{NI}{I} \times (1 + 15\%) \times (1 - \frac{15\%}{3}) \approx \frac{NI}{I} \times (1 + 15\% \times \left(1 - \frac{1}{3}\right))$$

And in general:

$$\frac{NI'}{I'} = \frac{NI \times (1 + g)}{I \times (1 + \frac{g}{PtB})} \approx \frac{NI \times (1 + g)}{I} \times \left(1 - \frac{g}{PtB}\right) \approx \frac{NI}{I} \times \left(1 + g \times \left(1 - \frac{1}{PtB}\right)\right),$$

an expression that reflects a change in return by a factor $g \times \left(1 - \frac{1}{PtB}\right)$.

If Price to Book is 1, there shall be no additional impact from growth on the expected return on capital: the investor is to obtain immediately or with delay the net income and its expected return is the inverse of the P/E. If price to book is different from 1, the conditions prevailing have an impact on the investor's contribution to growth, whether positive (PtB>1) or negative (PtB<1) per relation (3).

In practice, relation (3) is an alternative to cash flow models which proves capable to provide estimates of expected return similar to those that can be obtained through data intensive multi-periods cash flow modelling.

The three parameters $(P/E, PtB, g)$ can be adjusted to reflect economic mid-cycle points for net income and book value (in a manner similar to R. Shiller adjustments to P/E), based on historical as well as prospective net income and with long term growth derived from historical data and forecasts likewise.

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Appendix – Choice of parameters

The data table available from the Valphi site provides cost of equity estimates for all listed companies which stocks are among constituents of the French SBF 120 and CAC 40 equity indices.

Columns are numbered from 1 to 30 and corresponding fields are listed below:

Col. 1 to 4 SBF 120 constituent company name, CAC 40 constituents, stock price and market capitalization

Key findings

Col. 5 to 6 Central values for cost of equity estimates derived from stock multiples (CoE1) and CAPM model (CoE2), and for the latter with equity premium based on median value of CoE1 index estimates.

CoE1 is defined as a weighted average of (i) the cost of equity based on the last 10 years net earnings – column 7. CoE1(E.10y) – with a 1/3rd weight and (ii) the cost of equity based on the last 3 years reported net earnings and the next 3 years net earnings forecasts – column 8. CoE1(E.+/-3y) – with a 2/3rd weight. Weight is nil when one of the two costs of capital is not available or not significant.

Such 1/3rd-2/3rd weighting is to reflect preference for latest reported (last 3 years) and forecasted (next 3 years) net earnings although ensuring net earnings over full economic cycle (10 years) are taken into account.

In the absence of sufficient data, CoE1(E.+/-3y) is replaced in priority by (1) a cost of equity estimate based on the last three years net earnings – column 9. CoE1(E.-3y) – or the next three years – column 10. CoE1(E.+3y) –, then by (2) the average of estimated costs of capital based on lowest and highest net earnings forecasts over the next three years – column 11. CoE1(E.Min+3y) and column 12. CoE1(E.Max+3y).

Intermediary results

Col. 7 to 12 Cost of equity estimates based on multiples with net earnings considered on average over different periods of time:

Col. 7.	7. CoE1(E.10y)	Last 10-years reported net earnings
Col. 8.	8. CoE1(E.+/-3y)	Last 3 years reported and next 3 years forecasted net earnings
Col. 9.	9. CoE1(E.-3y)	Last 3 years reported net earnings
Col. 10.	10. CoE1(E.+3y)	Next 3 years forecasted net earnings

	Col. 11.	11. CoE1(E.Min+3y)	Minimum net earnings out of next 3 years forecasts
	Col. 12.	12. CoE1(E.Min+3y)	Maximum net earnings out of next 3 years forecasts

Parameters

Col. 13 to 20 P/E and PtB stock multiples calculated as average inflation-adjusted aggregates over various periods of time:

	Col. 13.	13. P/E(10y)	Last 10 years reported net earnings
	Col. 14.	14. P/E(+/-3y)	Last 3 years reported and next 3 years forecasted net earnings
	Col. 15.	15. P/E(-3y)	Last 3 years reported net earnings
	Col. 16.	16. P/E(+3y)	Next 3 years forecasted net earnings
	Col. 17.	17. P/E(Min+3y)	Minimum net earnings out of next 3 years forecasts
	Col. 18.	18. P/E(Min+3y)	Maximum net earnings out of next 3 years forecasts
	Col. 19.	19. PtB(10y)	Last 10 years reported equity book value
	Col. 20.	20. PtB(3y)	Last 3 years reported equity book value
Col. 21	21. g		Nominal long term growth rate, i.e. (i) growth rate in real terms defined per (a) 1/3 weighting of average sales growth expected between FYn+1 and FYn+2, and (b) 2/3 weighting of a 2.5% expected long term growth rate in real terms, increased by (ii) inflation rate based on last 5 years average
Col. 22 to 25			Historical weekly betas over last 2, 3, 4 and 5 years, conditional upon R2>35% in stock returns linear regressions for betas calculations
	Col. 22.	22. Beta(2y)	2-year beta
	Col. 23.	23. Beta (3y)	3-year beta
	Col. 24.	24. Beta(4y)	4-year beta
	Col. 25.	25. Beta (5y)	5-year beta
Col. 26	26. Beta.CoE2		Beta used for CoE2 calculation, defined as: (a) Average of 2-year beta and 3-year beta assuming $\Delta(\beta(3y),\beta(2y)) x \Delta(\beta(4y),\beta(3y))$ is

		positive (i.e. unchanged trend in betas by considering last 2, 3 or 4 years of data) and the variation coefficient (σ/μ) is below 10%
		(b) Average of 2-year, 3-year and 4-year betas in case Δ(β(3y),β(2y))xΔ(β(4y),β(3y)) is negative, assuming the variation coefficient (σ/μ) is below 10%, or average of 2-year, 3-year, 4-year and 5-year betas if σ/μ is lower
Col. 27	27. Rf	Reference sovereign bond yield as a proxy for risk free rate (20-day average of French 10-year sovereign bond "OAT 10 ans")
Col. 28	28. ERP	Equity risk premium obtained by subtracting the risk free rate from the median SBF 120 CoE1 cost of equity

Additional data for information purposes

Col. 29 & 30 Dividend yields, i.e. dividends divided by latest stock price (average inflation-adjusted dividends paid over various periods of time)

Col. 29.	29. Div(10y)	Dividends paid over last 10 years
Col. 30.	30. Div(3y)	Dividends paid over last 3 years

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