

Tykoh Valuation Utility - user guide

v 1.1

Introduction

This guide describes a valuation utility that is basic in some ways and sophisticated in others - it combines a simple framework with advanced analytics. The utility's main purpose is to give "big-picture" insights into valuation principles, dynamics and sensitivities. It is downloadable from the following link: www.tykoh.com/downloads/TykohValuationUtility.xls

The utility's design goals are to:

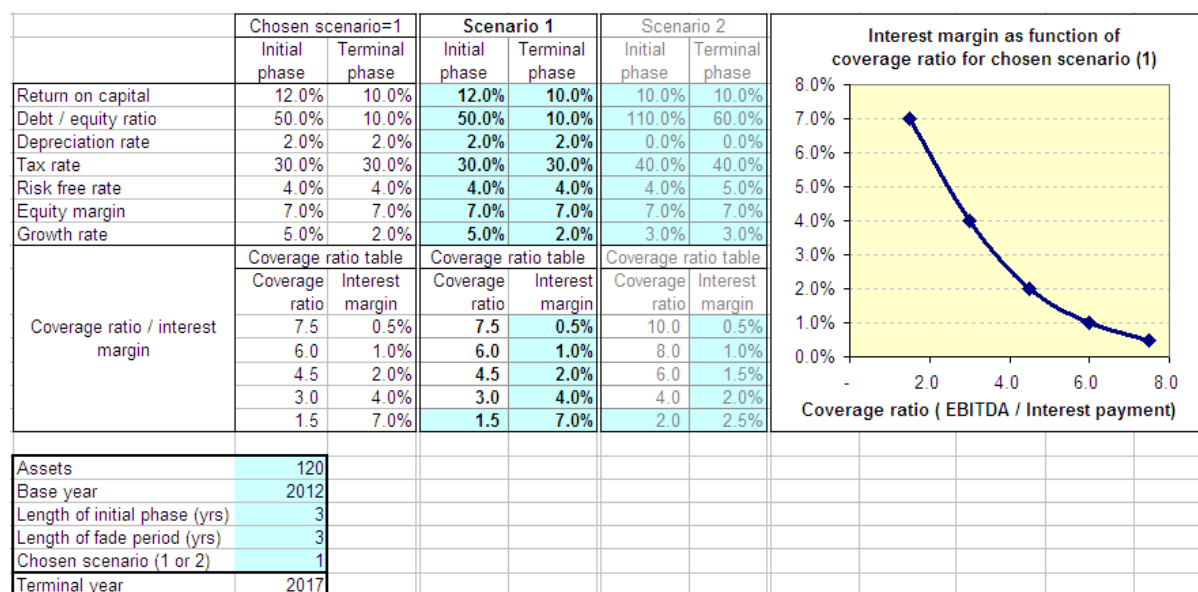
- Implement and reconcile discounted cash flow, ratio and economic profit approaches
- Provide transparency of calculation and methodology
- Incorporate sophisticated analytics
- Perform comprehensive term structure modelling of capital costs and value evolution
- Allow user-defined additions and calculations
- Give feedback about error conditions / invalid / inconsistent assumptions
- Do the preceding whilst avoiding having to use macros or iteration

This guide introduces the utility and shows how it can be used its results interpreted.

The utility has been produced by Tykoh Training (www.tykoh.com) and is used in some of Tykoh Training's workshops. The next part of this document describes the utility's inputs and usage.

Inputs / assumptions

The following illustration shows the inputs / assumptions used by the utility.



Inputs

Inputs - cells you can change - are shown in a light blue colour.

Scenarios

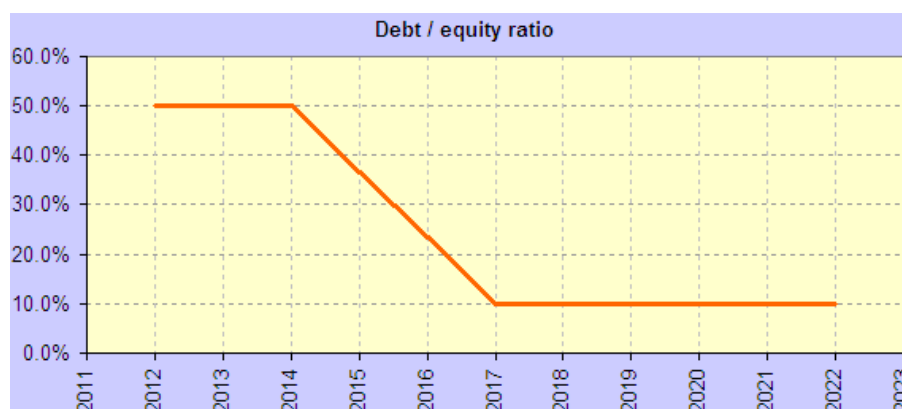
You can define two scenarios. You can choose which of the two scenarios are passed to the utility by selecting 1 or 2 in the cell labelled: "Chosen scenario (1 or 2)".

Three phases

Each scenario defines three phases in the life of the utility: An initial phase, a "fade" phase and a terminal / steady-state phase.

The length of the initial phase is defined in the cell labelled "Length of initial phase (yrs)". The length of the subsequent "fade" period is defined in the cell labelled "Length of fade period (yrs)". The following diagram illustrates how the three periods relate to each other.

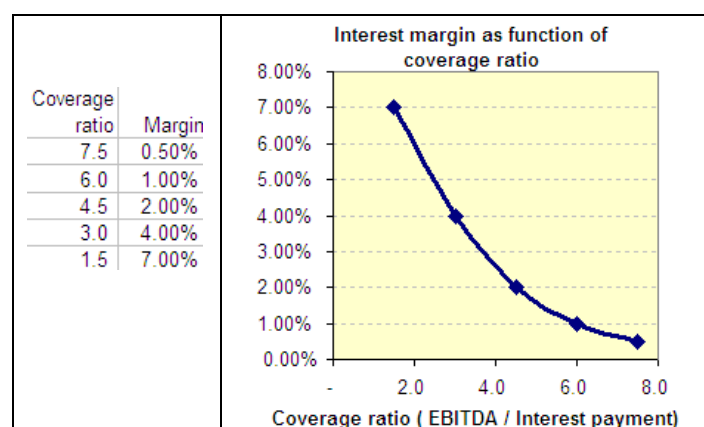
Consider the Debt / equity ratio defined in scenario 1. The ratio is defined to be 50% in the initial phase and 10% in the terminal phase. Over a 3 year fade period the ratio declines linearly from 50% to 10%.



After the fade period the debt / equity ratio stays at its terminal / steady state value.

Interest margin

The interest rate (pre-tax cost of debt) used in the utility is a risk free rate plus a margin. The margin is calculated dynamically from a user defined interest rate margin table. The table comprises two columns: Coverage ratios and margins. The coverage ratio is defined as earnings divided by interest payments. The following table shows a typical the coverage ratio table.



If the ratio of EBITDA to interest payment is 4.5 then the interest margin will be 2.0%. In that case if the risk free rate is 4.0% then the 2.0% margin added to the risk free rate will give an interest rate of 4.0% + 2.0% = 6.0%.

Return on capital

Return on capital [ROC] is defined in the following way:

$$ROC = \frac{EBIT * (1 - t)}{C}$$

where EBIT is earnings before interest and taxes (but after depreciation and amortisation), t is the marginal tax rate and C is capital.

For example, if EBIT is 20, tax rate is 30% and capital is 100 then the return on capital is:

$$ROC = \frac{20 * (1 - 0.3)}{100} = \frac{20 * 0.7}{100} = \frac{14}{100} = 14\%$$

Debt / equity ratio

The debt equity ratio is the book value of debt divided by the book value of equity.

For example if the book value of debt is 10 and the book value of equity is 50 then the debt equity ratio is $10 / 50 = 20\%$.

Depreciation rate

The depreciation rate is the dollar value of depreciation over a period divided by the book value of assets (or capital) at the beginning of the period.

For example if depreciation is 5 and opening assets are 200 then the depreciation rate is $5 / 200 = 2.5\%$.

If 60% of assets are depreciable and if those assets depreciate at the rate of 10% per year then the overall depreciation rate (across all assets) would be $60\% * 10\% = 6\%$.

Tax rate

The tax rate is the marginal rate of tax.

Risk free rate

This is the interest rate (pre-tax) on debt that is "risk-free". The utility maintains the risk free rate at the same level throughout its life. An interest margin, however, is added to the risk free rate and that evolves over the life of the utility.

Equity margin

This is the margin between the cost of unlevered equity and the risk free rate. The cost of unlevered equity is the return that equity investors would require if they supplied all of the firm's capital (i.e. the firm carried no debt).

If the cost of unlevered equity is 15%, for example, and the risk free rate is 4% then the equity margin is 11%.

Growth rate

The growth rate is the percentage increase in capital from one period to the next. If other parameters (debt / equity ratio, return on capital, etc) are constant then capital, debt, equity, earnings, taxes, etc will all grow by the same amount.

Assets

This is the book value of assets at the start of the first period.

Base year

This is the first year in the utility. Valuations are as at the start of the year. Cash flows are assumed to occur on the last day of each year.

Calculations

Following is a summary of the calculations performed in the utility.

Time varying assumptions

The time varying assumptions section generates the three phases in the life of the utility.

Year	2012	2013	2014	2015	2016	2017	2018
	+ 1	+ 2	+ 3	+ 4	+ 5	+ 6	+ 7
Time-varying assumptions							
Return on capital	12.00%	12.00%	12.00%	11.33%	10.67%	10.00%	-
Debt / equity ratio	50.00%	50.00%	50.00%	36.67%	23.33%	10.00%	-
Depreciation rate	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	-
Tax rate	30.00%	30.00%	30.00%	30.00%	30.00%	30.00%	-
Growth rate	5.00%	5.00%	5.00%	4.00%	3.00%	2.00%	-
Risk free rate	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	-
Equity margin	7.00%	7.00%	7.00%	7.00%	7.00%	7.00%	-

In the preceding diagram the leftmost numeric column shows the initial values of the time-varying assumptions. Those values are maintained for the initial period (3 years in this case). After that the parameters "fade" into their terminal or steady state values. The rightmost numeric column shows the parameters' terminal values. In the preceding example the depreciation rate, tax rate, risk free rate and equity margin are constant through the life of the utility but the return on capital, debt / equity ratio and growth rate have three separate phases.

Derived time varying assumptions

The derived time varying assumptions section calculates the cost of debt and equity. To calculate the cost of debt an interest margin (a function of the coverage ratio) is added to the risk free rate.

Derived time-varying assumptions							
Cost of debt (pre tax)	4.01%	4.01%	4.01%	4.00%	4.00%	4.00%	-
Cost of debt (post tax)	2.80%	2.80%	2.80%	2.80%	2.80%	2.80%	-
Unleveraged cost of equity	11.00%	11.00%	11.00%	11.00%	11.00%	11.00%	-
Cost of equity	13.42%	13.49%	13.57%	12.94%	12.25%	11.54%	-

Another calculation is done to calculate the leveraged cost of equity (the cost of equity taking into account the debt to equity ratio). The formula used to calculate the leveraged cost of equity is the following:

$$K_e = K_u + \frac{D^*(1-t)}{E} * (K_u - K_d)$$

where K_e is the leveraged cost of equity, K_u is the unleveraged cost of equity, D and E are the market values of debt and equity respectively, t is the tax rate and K_d is the cost of debt.

Balance sheet, income statement and cash flow statement

The balance sheet, income statement and cash flow statements are next calculated using values from the time-varying assumptions. In each period care has to be taken in calculating the financing and investing cash flows so that: 1) the ratio of debt to equity in the subsequent period is set to the

correct (time varying) level, 2) the absolute values of debt and equity in the subsequent period are set to so as to grow the capital and assets by the defined amount, and 3) the entire free cash flow to equity is paid out as a dividend. [This last constraint is somewhat arbitrary but this utility assumes the entire free cash flow is paid out.]

	2012	2013	2014	2015	2016	2017	-
Balance sheet							
Assets	120.00	126.00	132.30	138.92	144.47	148.81	-
Debt	40.00	42.00	44.10	37.27	27.33	13.53	-
Equity	80.00	84.00	88.20	101.65	117.14	135.28	-
Income statement							
EBITDA	22.97	24.12	25.33	25.27	24.90	24.23	-
(Depreciation)	(2.40)	(2.52)	(2.65)	(2.78)	(2.89)	(2.98)	-
EBIT	20.57	21.60	22.68	22.49	22.01	21.26	-
(Interest)	(1.60)	(1.68)	(1.77)	(1.49)	(1.09)	(0.54)	-
EBT	18.97	19.92	20.91	21.00	20.92	20.72	-
(Tax)	(5.69)	(5.98)	(6.27)	(6.30)	(6.28)	(6.22)	-
Net profit	13.28	13.94	14.64	14.70	14.64	14.50	-
Cash flow statement							
<i>Cash flow from operations</i>							
Net profit	13.28	13.94	14.64	14.70	14.64	14.50	-
Plus depreciation	2.40	2.52	2.65	2.78	2.89	2.98	-
Cash flow from operations	15.68	16.46	17.29	17.48	17.53	17.48	-
<i>Cash flow from financing</i>							
Dividends	(9.28)	(9.74)	(1.19)	0.79	3.49	(11.80)	-
Borrowing	2.00	2.10	(6.83)	(9.94)	(13.80)	0.27	-
Cash flow from financing	(7.28)	(7.64)	(8.02)	(9.14)	(10.31)	(11.53)	-
<i>Cash flow from investing</i>							
Replacement CAPEX	(2.40)	(2.52)	(2.65)	(2.78)	(2.89)	(2.98)	-
Growth CAPEX	(6.00)	(6.30)	(6.62)	(5.56)	(4.33)	(2.98)	-
Cash flow from investing	(8.40)	(8.82)	(9.26)	(8.33)	(7.22)	(5.95)	-
Net cash flow	-	-	-	-	0.00	-	-

Free cash flows, values, costs and returns

In this section free cash flows are determined and brought back to present value by discounting at the cost of capital. Equity cash flows are discounted at the cost of equity and debt cash flows at the post-tax cost of debt. A calculation is performed for each period because the cost of equity and of debt may vary. The market value of the firm is then obtained by summing the market values of equity and debt.

The utility assumes the firm's assets are all operating assets and in that case the value of the firm equals the value of the operations.

Free cash flows							
Free cash flow to equity	9.28	9.74	1.19	(0.79)	(3.49)	11.80	-
Free cash flow to debt	(0.88)	(0.92)	8.07	10.98	14.57	0.11	-
Free cash flow to the firm	8.40	8.82	9.26	10.19	11.08	11.90	-
Values							
Market value of equity	80.95	82.53	83.92	94.12	107.09	123.70	-
Market value of debt	40.00	42.00	44.10	37.27	27.33	13.53	-
Market value of firm	120.95	124.53	128.02	131.39	134.42	137.23	-
Costs and returns							
Cost of debt (post-tax)	2.80%	2.80%	2.80%	2.80%	2.80%	2.80%	-
Cost of capital [WACC]	9.91%	9.89%	9.86%	10.06%	10.33%	10.67%	-
Return on equity	16.60%	16.60%	16.60%	14.46%	12.50%	10.72%	-

The weighted average cost of capital is then obtained by using the costs of debt (post-tax) and equity and weighting by the market values of debt and equity.

Economic profit / value added

Economic value added (EVA) is then calculated. The value added (or subtracted) in each period is that period's return on capital less that period's cost of capital and the result of that multiplied by the book value of capital. The figures calculated in the utility for each period give the economic value / profit added from that period to perpetuity. The EVA is separated into two components: 1) EVA due to current investments (assets in place), and 2) EVA due to future investments (growth assets).

Economic value added							
Economic value added (EVA)	0.95	(1.47)	(4.28)	(7.53)	(10.05)	(11.57)	-
EVA per unit capital and no growth	0.02	0.01	(0.01)	(0.04)	(0.05)	(0.06)	-
EVA due to assets in place	2.90	0.71	(1.97)	(5.24)	(7.83)	(9.41)	-
EVA due to growth assets	(1.96)	(2.18)	(2.31)	(2.29)	(2.21)	(2.17)	-
Checks							
EVA & DCF reconcile	ok	ok	ok	ok	ok	ok	-

The DCF and EVA valuations are then reconciled to verify that the sum of invested capital and economic value added equals the market value of the firm as calculated by the DCF approach.

Ratios

Having calculated those values the utility calculates various ratios (market to book value, coverage ratio, etc).

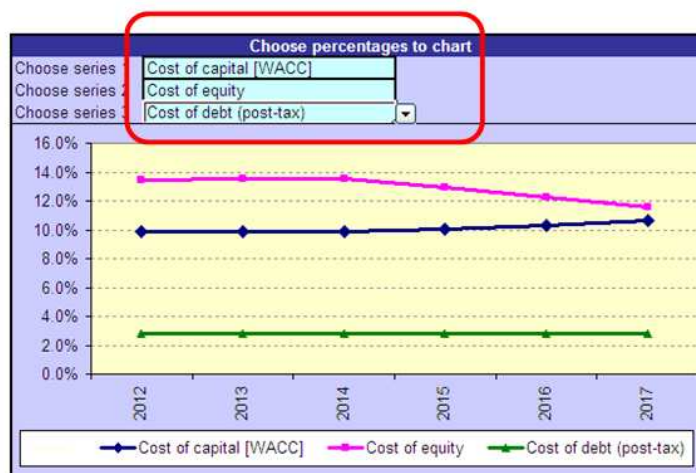
Ratios							
Coverage ratio	14.34	14.34	14.34	16.95	22.78	44.79	-
Equity [market / book] ratio	1.01	0.98	0.95	0.93	0.91	0.91	-
Firm [market / book] ratio	1.01	0.99	0.97	0.95	0.93	0.92	-
Enterprise value / EBITDA	5.27	5.16	5.05	5.20	5.40	5.66	-
P/E ratio	6.10	5.92	5.73	6.40	7.31	8.53	-

Time varies analysis

A number of charting and analysis features are available in the utility. The first is a "time varies" analysis. This analysis comprises three user selectable charts that show a selection of results from

the main utility calculations page. Chart selections can be made by using cells coloured light blue. In the following sample chart three "percentage" items are charted: The cost of capital, the cost of equity and the cost of debt.

Inputs (from main page)		
	Initial phase	Terminal phase
Return on capital	12.0%	10.0%
Debt / equity ratio	50.0%	10.0%
Depreciation rate	2.0%	2.0%
Tax rate	30.0%	30.0%
Risk free rate	4.0%	4.0%
Equity margin	7.0%	7.0%
Growth rate	5.0%	2.0%
	Coverage ratio	Margin
	7.5	0.50%
	6	1.00%
Interest margin	4.5	2.00%
	3	4.00%
	1.5	7.00%
Equity	100	
Base year	2012	
Length of initial phase	3	
Length of fade period	3	
Chosen scenario (1 or 2)	1	



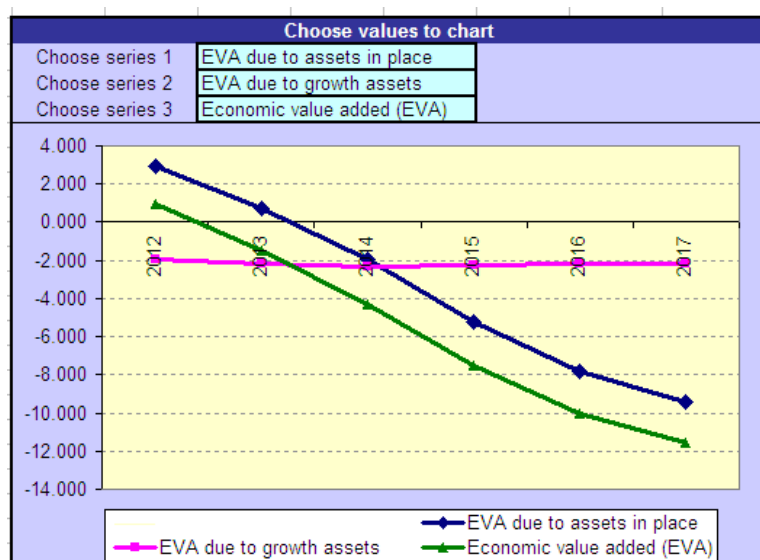
In the preceding example cost of equity is reducing during the fade period. That happens because leverage reduces over the fade period (from 50% to 10%) and so the riskiness of equity cash flows (post interest payments) falls. However, even though the cost of equity reduces WACC increases during the fade period. That is because the weighting (by market value) of equity increases relative to debt and equity's higher cost makes an increased contribution to the WACC. And - at least in this case - this effect dominates the preceding one.

In the second, "ratios" chart, shown on the right the user has chosen to display the P/E ratio and the EV / EBITDA ratio.

As one might expect the equity based ratio (P/E) moves more over time than does the firm based ratio (EV / EBITDA). That is because equity cash flows are post interest (and hence capital structure dependent) and the capital structure changes during the fade period.



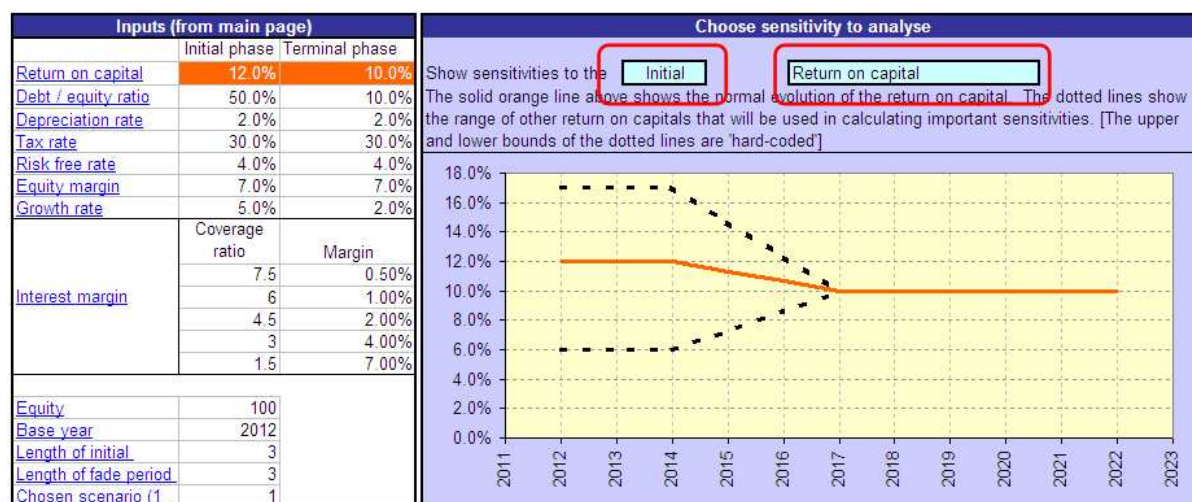
The last of the three charts on the time varies page are "values" charts. The following example charts Economic Value Added and its two components: EVA due to assets in place and EVA due to growth assets.



Assumptions vary analysis

The second type of analysis the utility performs allows assumptions to vary. In this analysis you can select a parameter to vary and the utility will show the effects of that parameter varying over a range of values.

The following diagram shows the top part of the assumptions varies page. The two light blue cells are user selectable. You can select which assumption to vary (e.g. return on capital, growth rate etc). You can also select whether you want to vary the initial or terminal value.

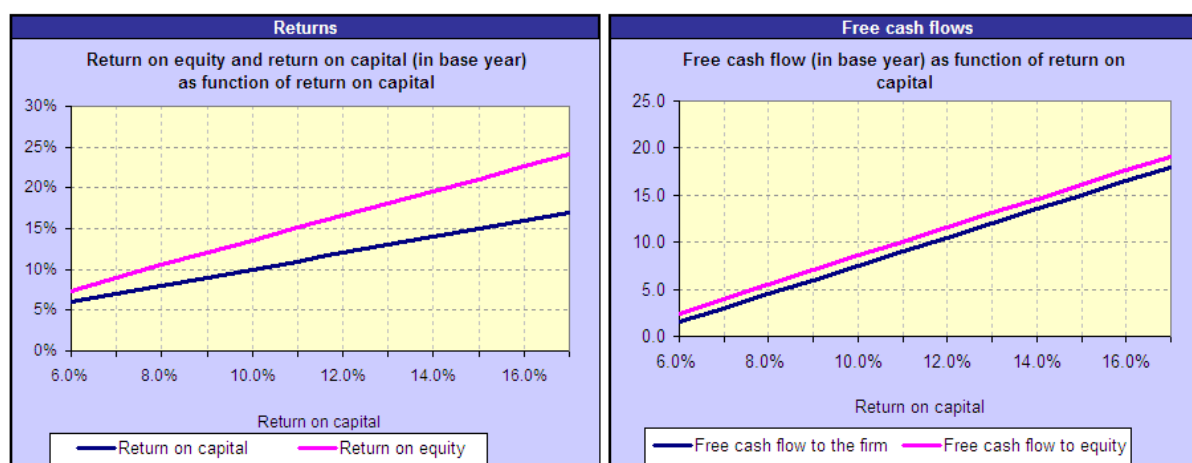


Consider the preceding example. The user has chosen to vary the initial return on capital. Currently, as defined in the utility, the return on capital in the initial phase is 12% and that fades to 10% in the terminal phase. The orange line in the preceding chart shows the default evolution of the return on capital. In the assumption-varies analysis a range of initial returns on capital are used. The dotted lines on the preceding chart show the range. Returns on capital ranging from a low of 6% to a high of 17% are used.

The results of the analysis are shown are reproduced following.

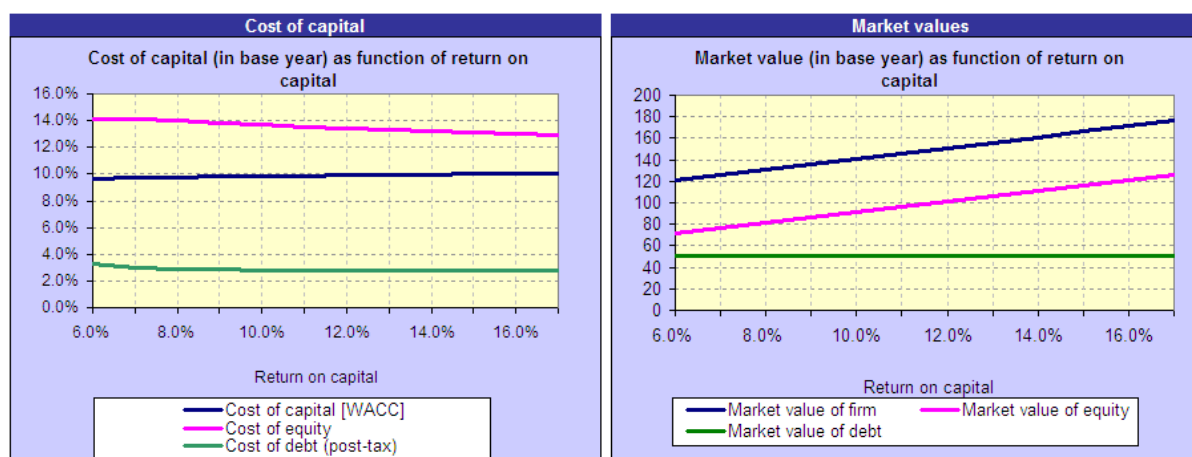
Returns and free cash flows

Return on equity and return on capital are shown as a function of the assumption being varied (the diagram on the left, following). Also displayed are the free cash flow to the firm and free cash flow to equity (the diagram on the right).



Cost of capital and market values

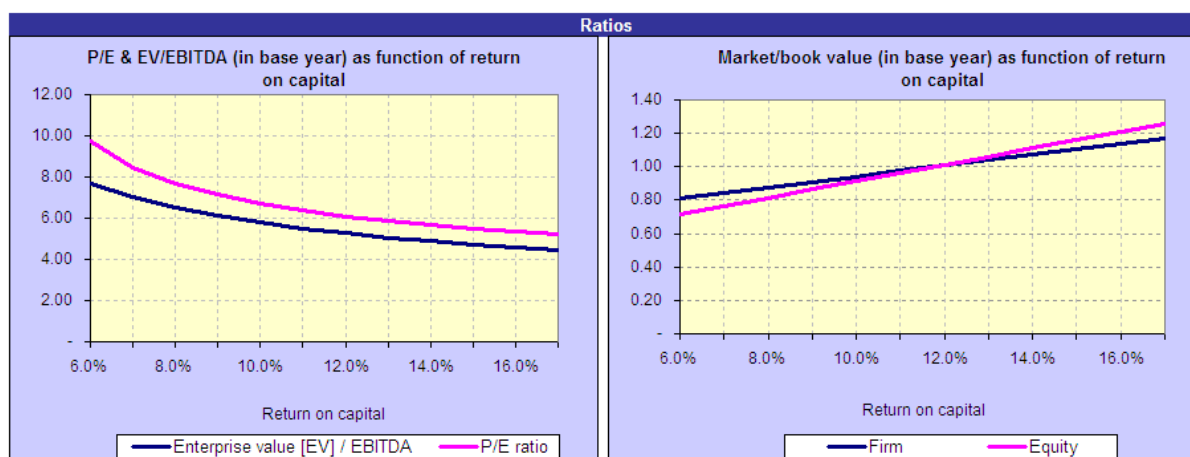
The cost of equity, cost of debt and cost of capital are shown (the diagram on the left). Also displayed are the market values of equity, debt and the firm (right).



Note in the left preceding chart the cost of debt reduces with increasing return on capital. That is because, at low returns of capital, EBITDA is low, the coverage ratio is low and a relatively high margin is added to the risk free rate to calculate the cost of debt. When return on capital increases EBITDA increases, the coverage ratio increases and the interest margin falls.

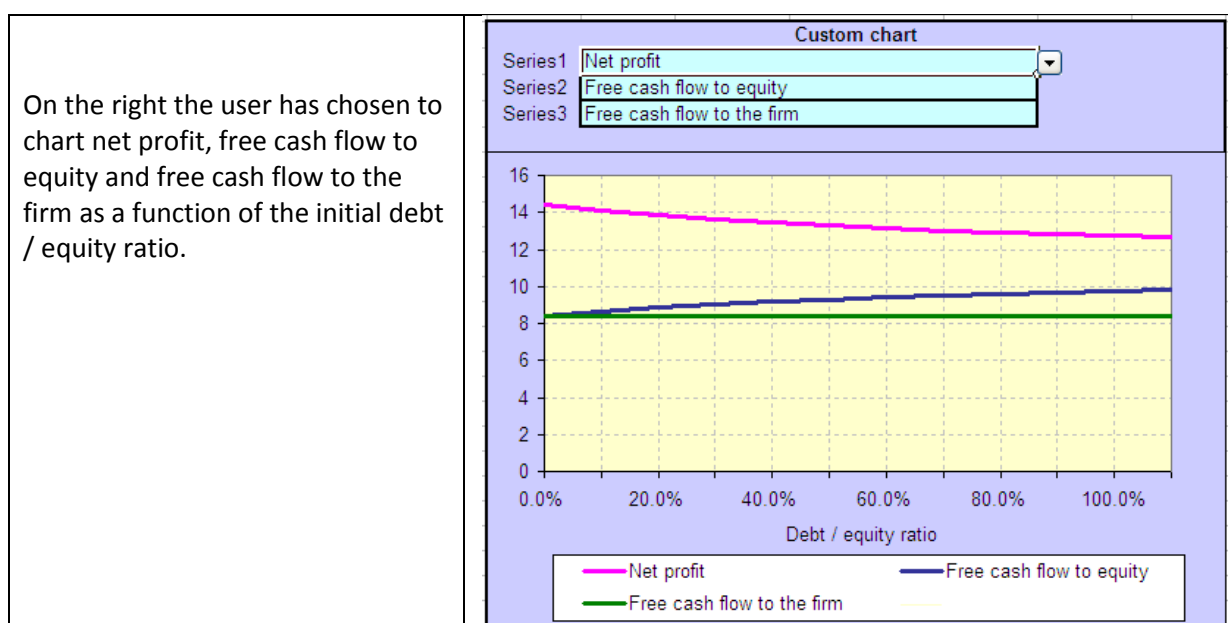
Ratios

Equity and enterprise ratios are calculated (the left, following diagram). Also shown are the ratios of market to book value for both firm and equity (right).

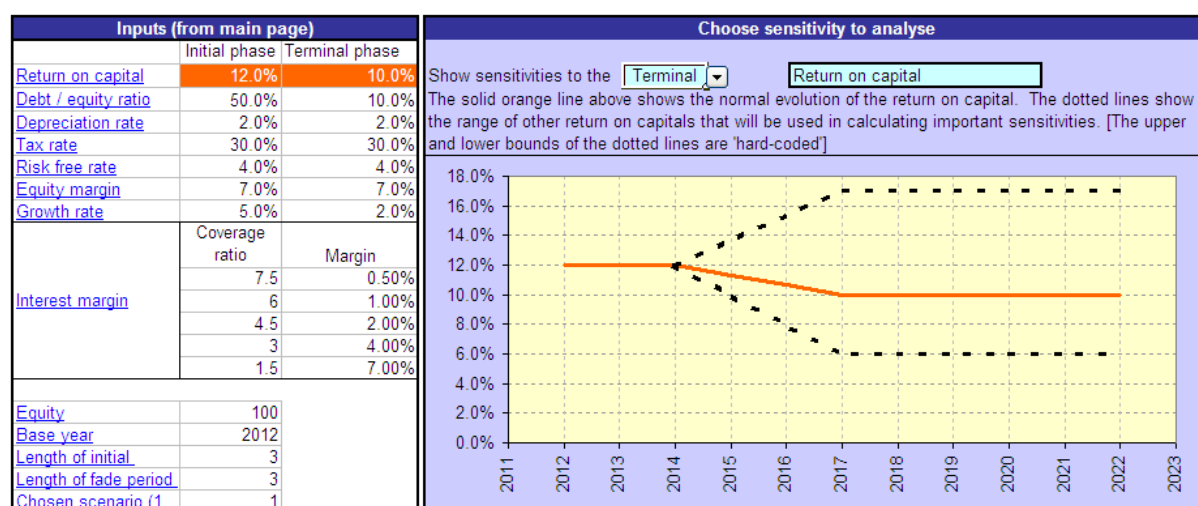


Custom charts

As well as the pre defined charts listed above a custom chart is available. That allows you to chart three series of your own choice. Following is an example.

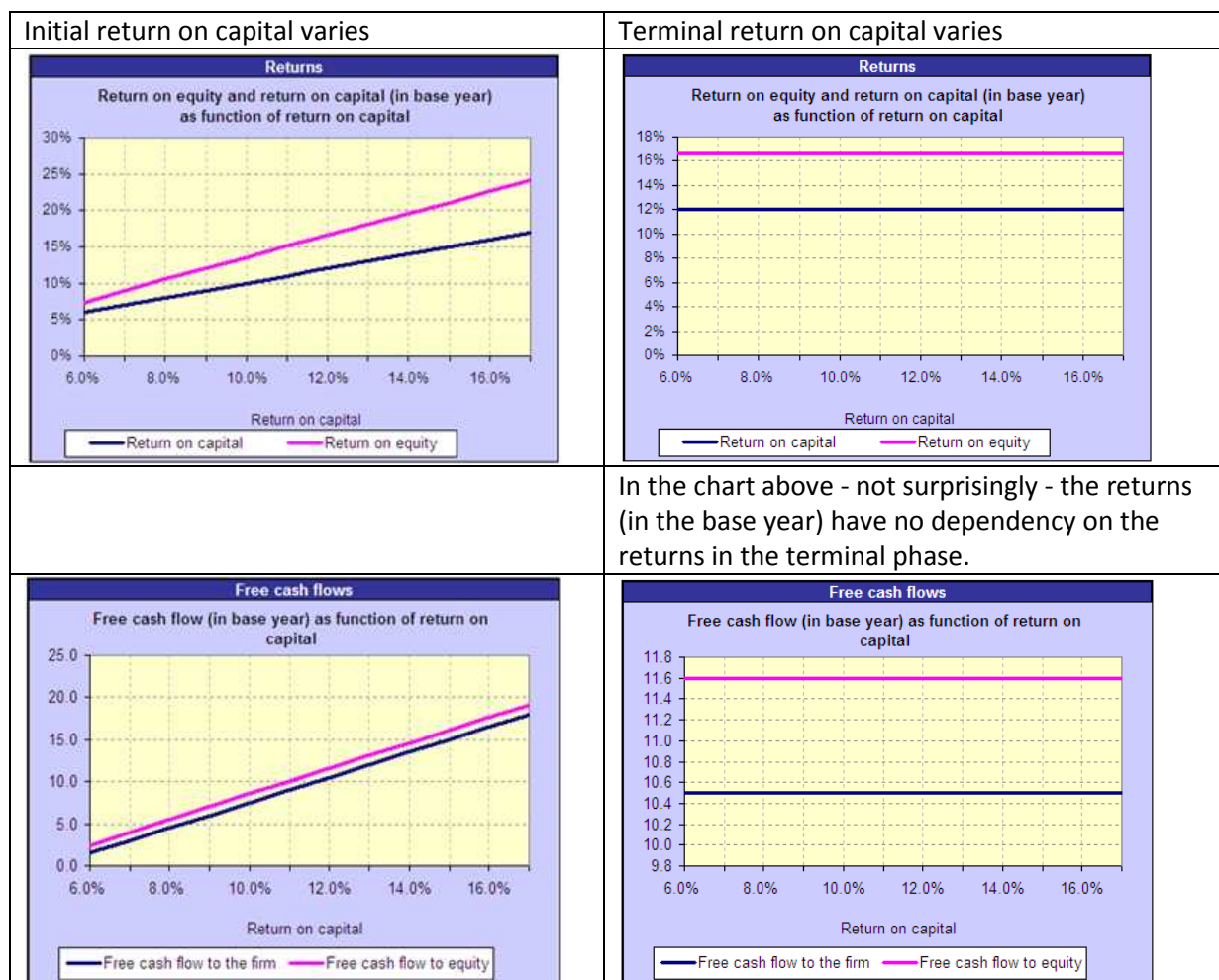


The preceding examples were obtained by varying the initial return on capital. It is interesting to compare those results with the results where the terminal return on capital is varied. The following chart shows the range of returns on capital used.

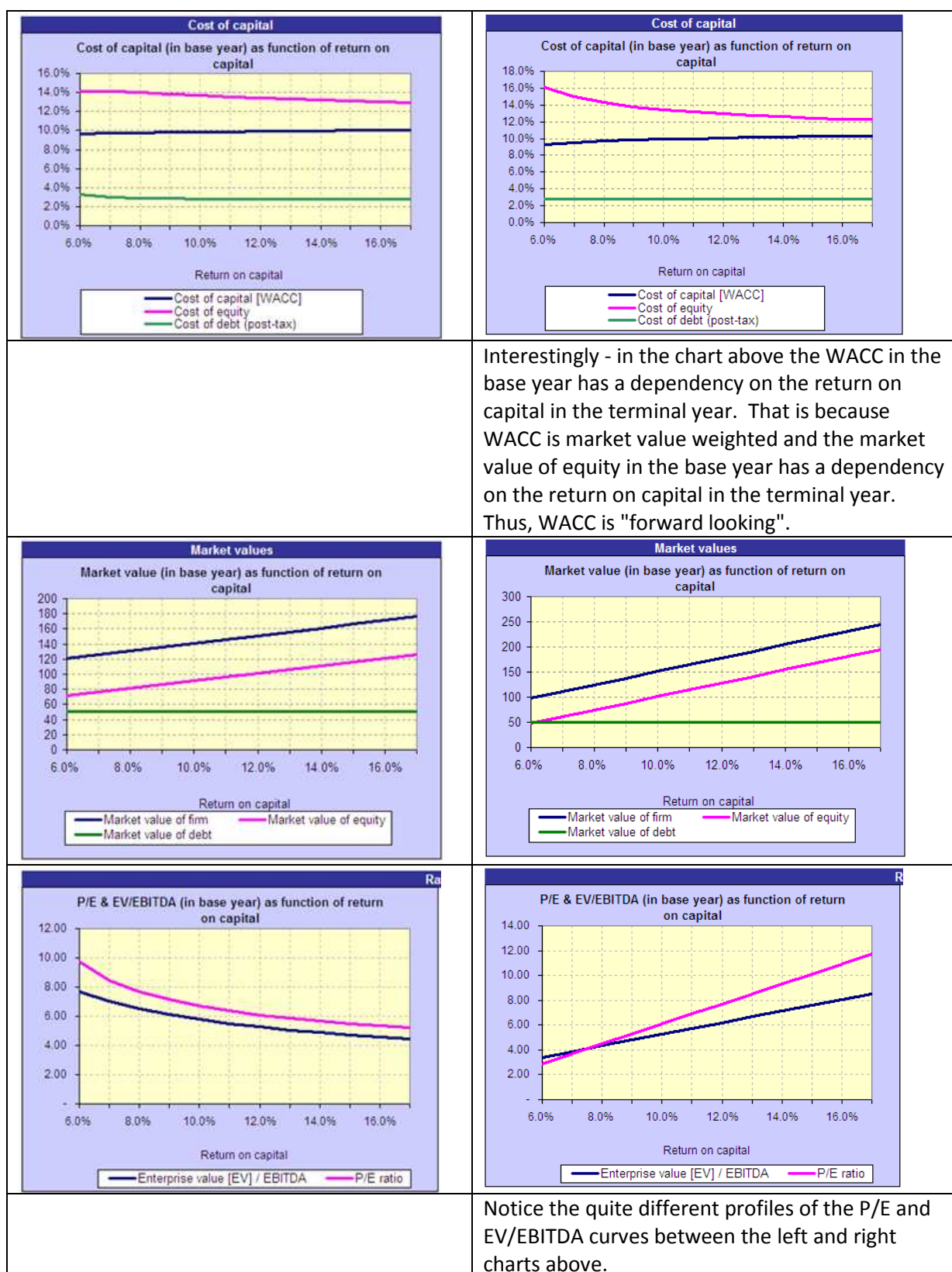


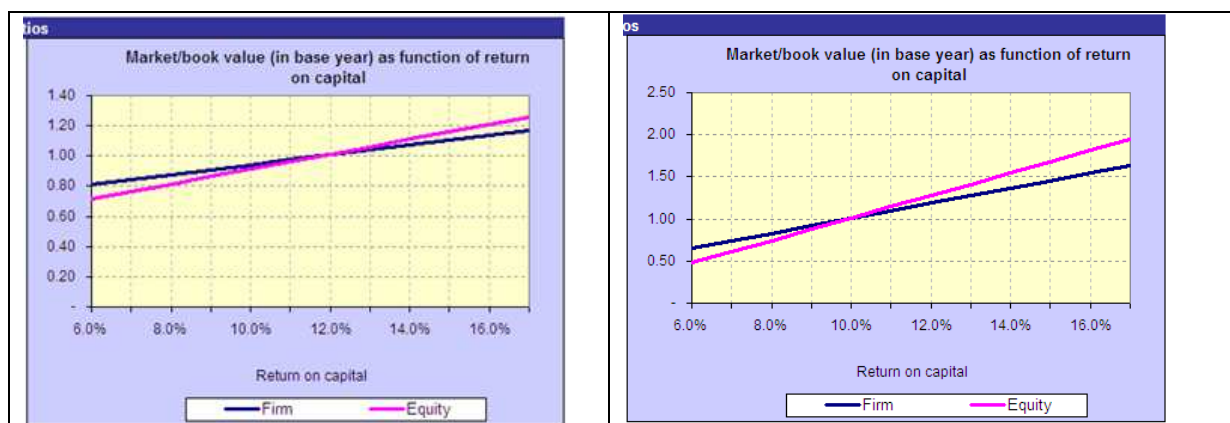
As before, returns vary between 6% and 17%. But this time the utility varies the terminal value rather than the initial value.

The new results are shown below and compared with the earlier results. In each case the left column shows the first results (initial return on capital varies) and the right column shows the second results (terminal return on capital varies).



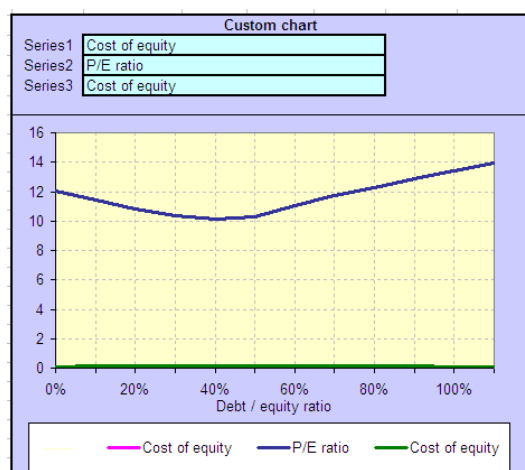
In the chart above - not surprisingly - the returns (in the base year) have no dependency on the returns in the terminal phase.



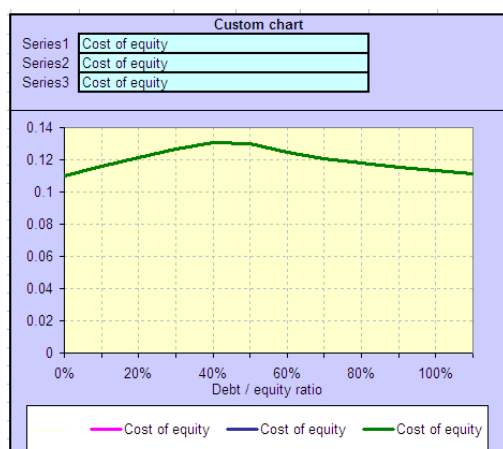


Custom charts - scales

If the quantities you are charting have widely different values then the smaller values may be "swamped" - as illustrated in the next example.

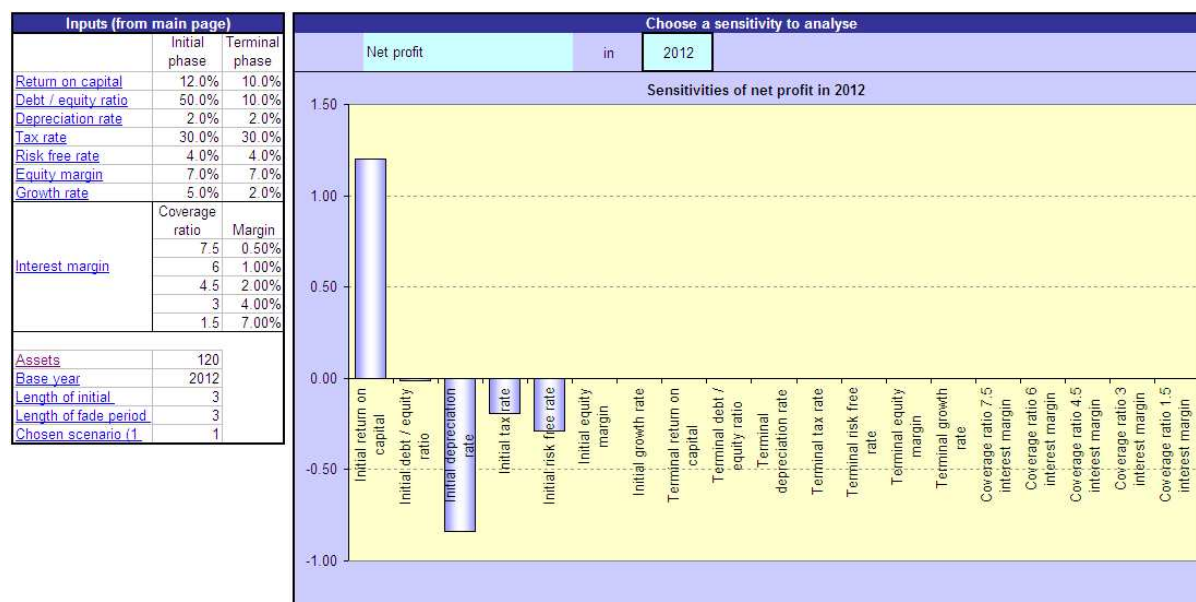


P/E and cost of equity are charted together. P/E is much larger than cost of equity and so P/E dominates the chart. If wish to "zero-in" on cost of equity then chart only that (three times) - as illustrated in the next diagram.



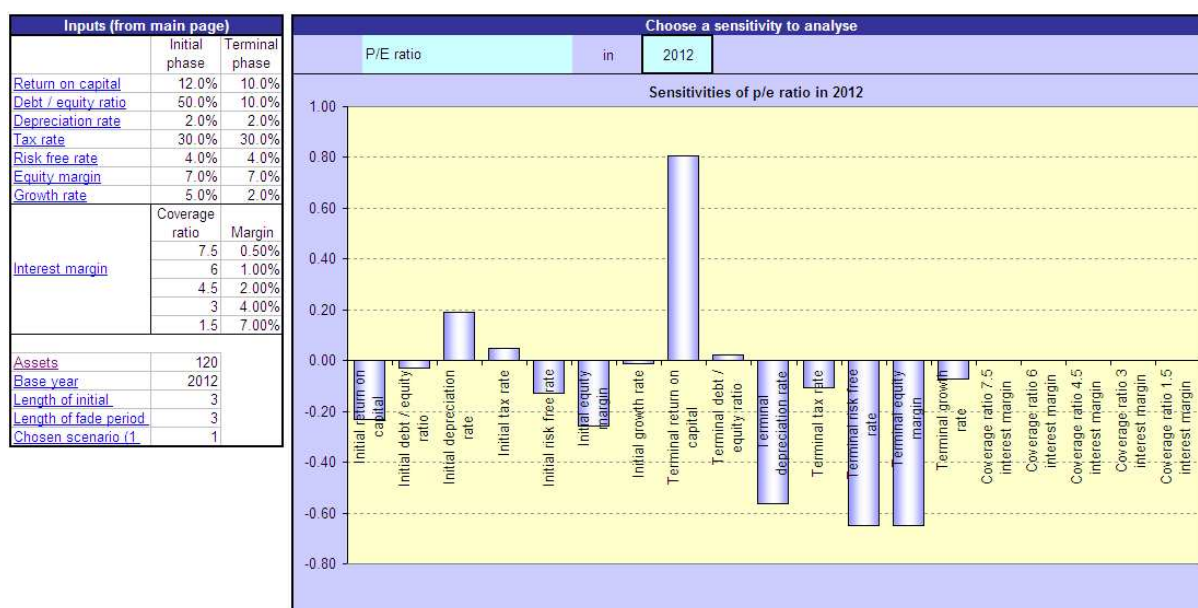
Sensitivity analysis

Sensitivity analysis lets you select a utility result (e.g. net profit, CAPEX, WACC) and lists its sensitivities. Sensitivity analysis works by increasing each utility input by 1% and calculating the effect of that change on the utility result. The sensitivity chart following illustrates this.



The preceding chart shows the sensitivities of net profit. The sensitivity to initial return on capital is approximately 1.2. That means that if return on capital were to increase by 1% (from 12% to 13% in this case) then net profit would rise by approximately 1.2. Initial assets are 120. So if this figure is in \$m then that translates to a profit increase of \$1.2m for a 1% increase in return on capital. The next most significant sensitivity is on depreciation rate. Each 1% increase in depreciation rate causes a reduction of approximately 0.8 in net profit. On a \$120m asset base that translates to a reduction in net profit of \$800,000. The next most significant sensitivity is on the risk-free rate (which feeds through into the interest rate paid on debt). A 1% increase in interest rate would cause a reduction in net profit of approximately \$250,000. The last significant dependency is on tax rate. A 1% increase tax would reduce profit by approximately \$200,000.

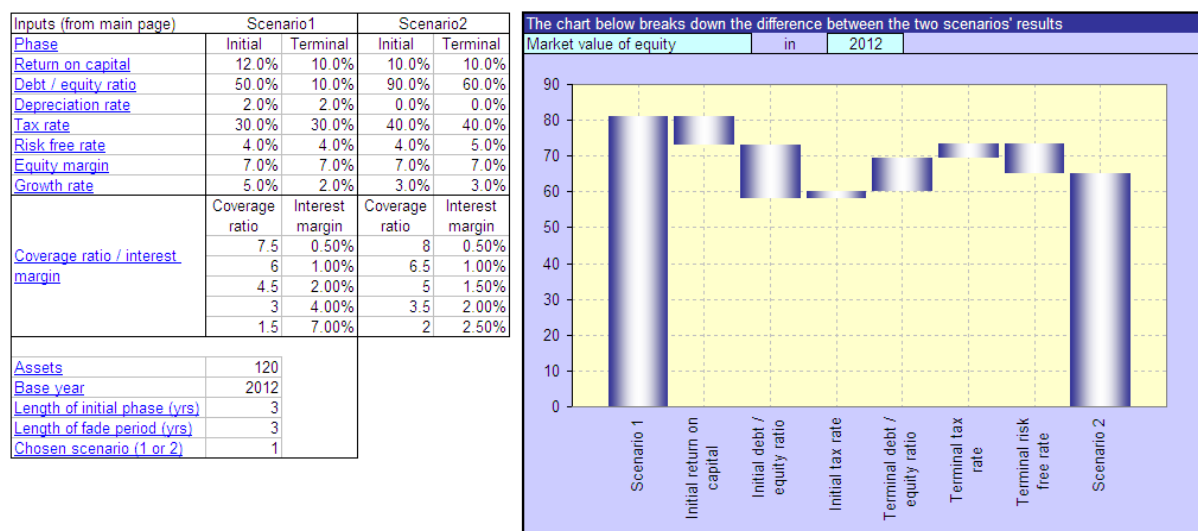
The preceding sensitivity profile is fairly simple and in accord with what one would expect. Other sensitivity profiles however are more complex and more thought is needed to understand why they are as they are. Consider, for example, the sensitivities of the P/E ratio shown next.



Some interesting observations can be made about the profile: Sensitivity to the initial depreciation rate is positive but is negative to the terminal depreciation rate. Sensitivities to the risk free rate and equity margin are the same in the terminal phase but differ in the initial phase. Both of these effects flow from the same cause: The denominator (earnings) depends only on current (initial) values whereas the numerator (price) depends on both current and futures values. Thus, earnings are sensitive only to the initial parameters whereas price depends on both the initial and terminal parameters.

Attribution analysis

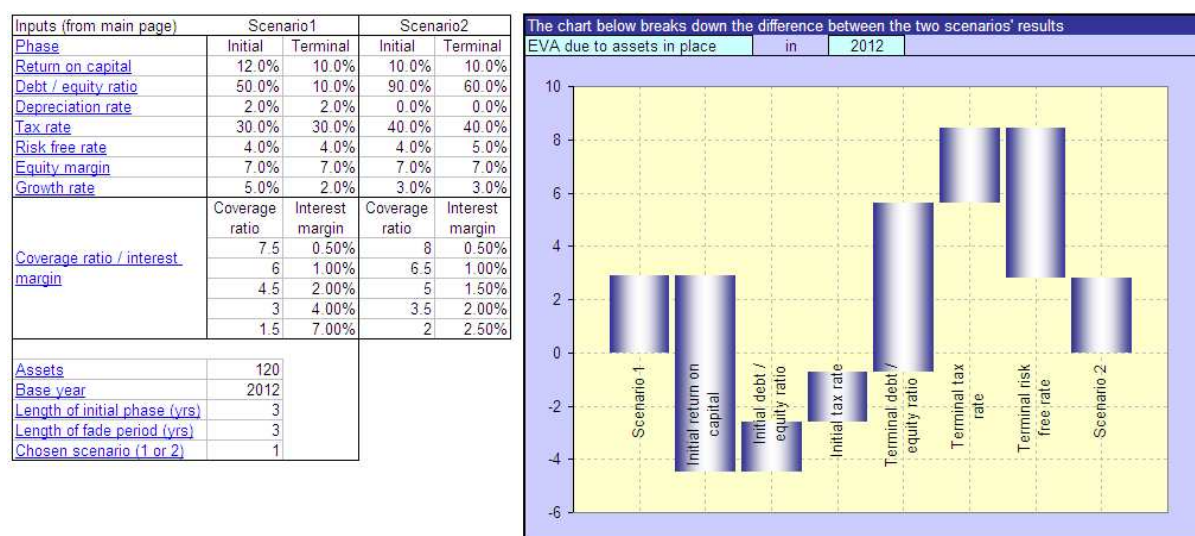
Attribution analysis considers a nominated result (e.g. market value of equity) under two scenarios. The analysis quantifies the contributing factors that cause the nominated result to have different values for the two scenarios. An example is shown next.



In the example being considered the market value of equity for scenario 1 (the leftmost column in the chart) is 80.95. Scenario 2's market value of equity (the rightmost column) is 65.40. The columns between the two scenarios break down the difference into the contributing factors. The

second-from-the-left column shows that "initial return on capital" (which is 12% in scenario 1 and 10% in scenario 2) reduces market value of equity by approximately 7. The next column shows that "initial debt / equity ratio" (which is 50% in scenario 1 and 90% in scenario 2) reduces market value of equity by approximately 13. The next column - "initial tax rate" - adds approximately 3. And so on. The analysis chart is sometimes referred to as a "flying brick" chart.

Another example is shown next. The example is an attribution related to economic profit due to assets in place.



User defined calculations

As well as using the utility's "built in" calculations you can also define your own. Your calculations can then be charted and analysed in exactly the same way as with the "built in" calculations. The user defined calculations section is shown next.

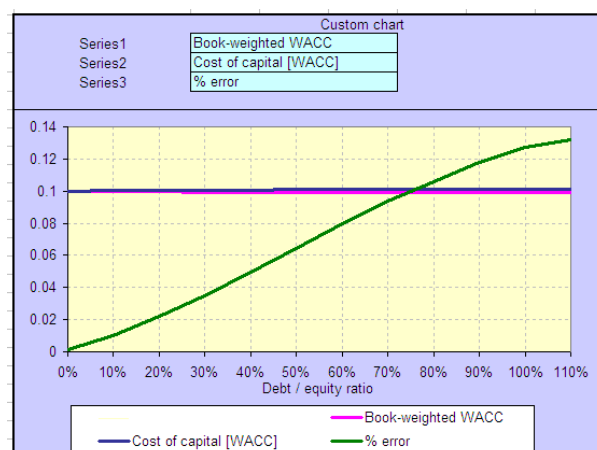
You can change the labels in the leftmost column from their default values to whatever you want.

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
User defined calculations														
User defined calc #1														
User defined calc #2														
User defined calc #3														
User defined calc #4														
User defined calc #5														
User defined calc #6														
User defined calc #7														
User defined calc #8														

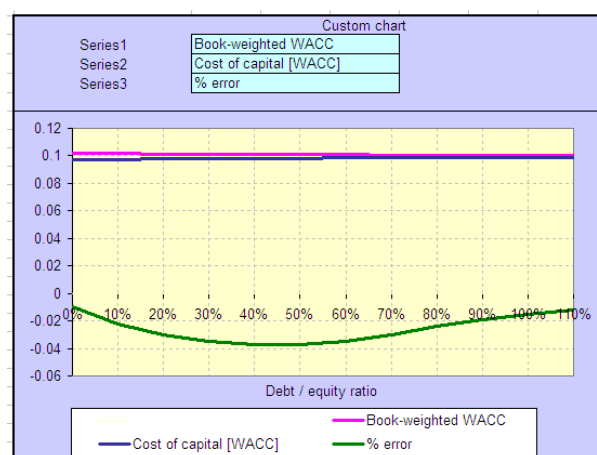
In the following example the user defined section has been used to determine the valuation error that would result from using book-value weights in a WACC calculation rather than the correct market value weights. On the third user defined row the book weighted WACC is calculated. On the fourth row the resulting firm value figures have been calculated. And the next row calculates the percentage difference between market weighted WACC valuation and book weighted WACC valuation.

	2012	2013	2014	2015										
User defined calculations														
Firm value using WACC	132.55	138.72	145.49	149.60	-	-	-	-	-	-	-	-	-	-
User defined calc #2	On the next line we try valuing the firm with a book-value weighted WACC (that isn't the right way - we just want to see what the error would be)													
Book-weighted WACC	9.93%	9.91%	9.58%	9.51%										
Firm value using above	141.09	147.91	155.30	159.77	-	-	-	-	-	-	-	-	-	-
% error	6.45%	6.62%	6.75%	6.80%	<<<< we'll chart this									
User defined calc #6														
User defined calc #7														
User defined calc #8														

And, as a matter of interest when the terminal return on capital is 12%, the percentage error as a function of debt / equity ratio looks like the following:



And when the terminal return on capital is 9% it looks like this:



Feedback and suggestions for improvement

If you have feedback about this utility or suggestions for improvement please contact us at the following address: info@tykoh.com

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