Determining the Residual Value: a short note on Equations

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The residual value is often based on the following equation,

$$V_L = \frac{IC_0 * Roic * \left[1 - \frac{g}{Roic}\right]}{Wacc - g} = \frac{IC_0 * [Roic - g]}{Wacc - g} \qquad (1)$$

The IC_0 can be rewritten as,

$$IC_0 = \frac{IC_0 * [Wacc - g]}{Wacc - g} \qquad (2)$$

If Roic > Wacc the market value of the firm is higher than the book value, which means that,

$$V_L = IC_0 + MVA \qquad (MVA = market\ value\ added) \qquad (3)$$

The Market Value Added can be expressed as follows,

$$MVA = V_L - IC_0 \rightarrow \frac{IC_0 * [Roic - g]}{Wacc - g} - \frac{IC_0 * [Wacc - g]}{Wacc - g} = \frac{IC_0 * [Roic - Wacc]}{Wacc - g} \qquad (4)$$

This means that we can rewrite equation (3) as,

$$V_L = IC_0 + \frac{IC_0 * [Roic - Wacc]}{Wacc - g} \qquad (5)$$

This equation can be expressed in the normal series approach as,

$$\boldsymbol{V_L = IC_0 + \sum_{t=1}^{\infty} \frac{IC_0 * (Roic - Wacc) * (1 + g)^{t-1}}{(1 + Wacc)^t}} \qquad (\boldsymbol{6})$$

The central issue in executing equation (6) is whether a high excess return assumed in the residual value is consistent with a competitive economy in which even the typical large firm has difficulty earning more than its cost of capital (Biddle et al, 1999). If after the forecast (or explicit) period excess return is assumed to be high, it is arguable to downsize this excess return gradually over time (n = years). This means that equation (6) should be adjusted with an “***adjusted fade rate***” called ***f*** (Holland, 2018). In this respect, we can use an approach (approach #1) where the return spread converges to zero (or a residual spread) in the limit or an approach (approach #2) where the return spread becomes zero (or a residual spread) after a given period.

<u>**Approach #1 – Converges to zero in the limit**</u>

$$\boldsymbol{V_L = IC_0 + \sum_{t=1}^{\infty} \frac{IC_0 * (Roic - Wacc) * (1 - f)^{t-1} * (1 + g)^{t-1}}{(1 + Wacc)^t}} \qquad \mathbf{(7)}$$

Equation (7) can be rewritten as a residual equation as follows,

$$\boldsymbol{V_L = IC_0 + \frac{IC_0 * [Roic - Wacc]}{Wacc - g + f + f * g}} \qquad \mathbf{(8)}$$

If we want to know the spread (Roic – Wacc) takin on a certain value ***s*** (say 50%, or 0,001%) in each number of years, we can use:

$$(Roic - Wacc) * (1 - f)^n = s$$

$$(1 - f) = \left(\frac{s}{(Roic - Wacc)}\right)^{1/n}$$

$$f = 1 - \left(\frac{s}{(Roic - Wacc)}\right)^{1/n} \qquad (9)$$

For instance, when we assume that the spread is 0,001% after 5 years (n) based on the actual Roic-Wacc spread of 10%, the adjustable fade rate is equal to $1 - \left(\frac{0{,}001\%}{0{,}10}\right)^{\frac{1}{5}} = 0{,}842.$

<u>**Approach #2 – Becomes zero after a given period**</u>

$$\boldsymbol{V_L = IC_0 + \sum_{t=1}^{T} \frac{IC_0 * (Roic * (1 - f)^{t-1} - Wacc) * (1 + g)^{t-1}}{(1 + Wacc)^t}} \qquad \mathbf{(10)}$$

Equation (10) can be rewritten as a residual equation as follows,

$$V_L = IC_0 + IC_0 \left[Roic * \frac{\left[1 - \frac{[(1-f)*(1+g)]^T}{(1+Wacc)^T}\right]}{Wacc - g + f + f*g} - Wacc * \frac{\left[1 - \frac{(1+g)^T}{(1+Wacc)^T}\right]}{Wacc - g} \right] \quad (11)$$

Note that the factors following Roic and Wacc are the standard growing annuity factors and T is equal to n+1.

We assume that the (competitive advantage) return spread (Roic – Wacc) goes to zero at a decrease ***f*** in ***T+1*** years (where the +1 is here because the decrease only starts in year t+1):

$$Roic * (1-f)^n = Wacc \qquad (12)$$

This implies we can solve f, given the competitive advantage period (T) as,

$$f = 1 - \left(\frac{Wacc}{Roic}\right)^{\frac{1}{n}} \qquad (13)$$

For instance, when Roic is 25% and Wacc 10% and the competitive advantage period (n) is limited to maximum 5 years, the adjustable fade rate is equal to $1 - \left(\frac{0{,}10}{0{,}25}\right)^{\frac{1}{5}} = 0{,}1674$.

Examples:

Approach #1 – Converges to zero in the limit

Roic	24,00%
Wacc	12,00%
g	2,00%
Epmin	0,00001%
N	5,00
f (EP)	0,94

	0	1	2	3	4	5	6
,	1.000,00	1.020,00	1.040,40	1.061,21	1.082,43	1.104,08	1.126,16
ROIC	24,00%	12,730037%	12,044413%	12,002702%	12,000164%	12,000010%	12,000001%
EP	12,00%	0,730037%	0,044413%	0,002702%	0,000164%	0,000010%	0,000001%
Nopat		240,00	129,85	125,31	127,37	129,89	132,49
Invest		20,00	20,40	20,81	21,22	21,65	22,08
FcF		220,00	109,45	104,50	106,15	108,24	110,41
Roic - EPmin = Wacc		0	0	0	0	0	1
PV		196,43	87,25	74,38	67,46	61,42	55,94
PV							570,55
Total TV	1.113,427246						
Equation (8)	1.113,4272496						

$$V_L = IC_0 + \frac{IC_0 * [Roic - Wacc]}{Wacc - g + f + f * g} \qquad (8)$$

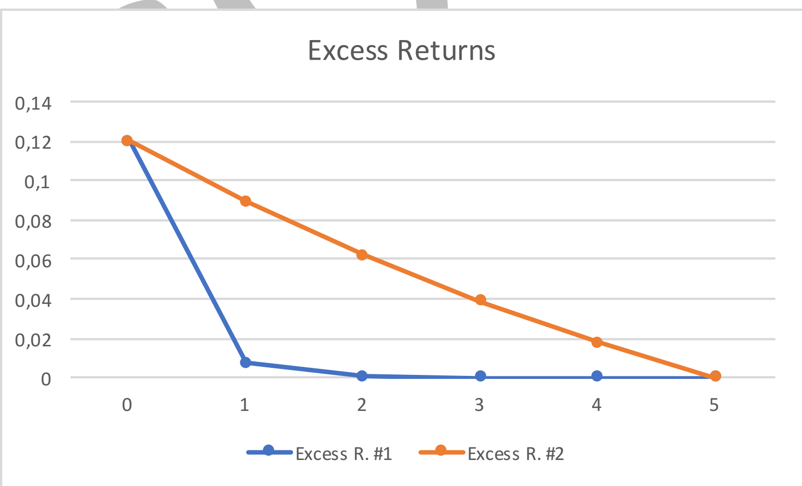
Approach #2 – Becomes zero after a given period

Roic	24,00%
g	2,00%
Wacc	12,00%
f	12,94%
N	5,00

	0	1	2	3	4	5	6
IC	1.000,00	1.020,00	1.040,40	1.061,21	1.082,43	1.104,08	1.126,16
ROIC	24,00%	20,89%	18,19%	15,83%	13,78%	12,00%	10,45%
Nopat		240,00	213,11	189,23	168,03	149,21	132,49
Invest		20,00	20,40	20,81	21,22	21,65	22,08
FcF		220,00	192,71	168,43	146,81	127,56	110,41
Roic = Wacc		0	0	0	0	0	1
PV		196,43	153,63	119,88	93,30	72,38	55,94
PV		0,00	0,00	0,00	0,00	0,00	570,55
Total TV	1.262,103						
Equation (11)	1.262,103						

$$V_L = IC_0 + IC_0 \left[Roic * \frac{\left[1 - \frac{[(1-f) * (1+g)]^T}{(1+Wacc)^T}\right]}{Wacc - g + f + f * g} - Wacc * \frac{\left[1 - \frac{(1+g)^T}{(1+Wacc)^T}\right]}{Wacc - g} \right] \qquad (11)$$

Difference between approach #1 and #2:



How long are Competitive Advantage Periods and is it realistic to assume that a small spread remains after the explicit competitive advantage period?

It is often assumed that after the CAP Roic is equal to Wacc, which means that no added value is generated after this period (Market Value = Invested Capital). This means that management is not any longer be able to invest in positive NPV projects, which is rather a blunt statement. It is imaginable that after the CAP a small spread remains, implying that management is capable to invest in positive NPV projects after CAP[1]. This means that equations (8) and (10) must be adjusted to assume that a small spread remains after CAP.

$$\boldsymbol{V_L = IC_0 * (Roic - Wacc) * \frac{\left[1 - \frac{[(1-f)*(1+g)]^T}{(1+Wacc)^T}\right]}{Wacc - g + f + f*g} + \frac{IC_0 * (1+g)^T * (Roic - Wacc) * (1-f)^n}{Wacc - g} * \frac{1}{(1+Wacc)^T} + IC_0} \quad \textbf{(14)}$$

where, $f = 1 - \left(\frac{S}{Roic - Wacc}\right)^{\frac{1}{n}}$, (S = permanent spread), and T = n+1

and

$$\boldsymbol{V_L = IC_0 + IC_0 \left[Roic * \frac{\left[1 - \frac{[(1-f)*(1+g)]^T}{(1+Wacc)^T}\right]}{Wacc - g + f + f*g} - Wacc * \frac{\left[1 - \frac{(1+g)^T}{(1+Wacc)^T}\right]}{Wacc - g}\right] + \frac{IC_0 * (1+g)^T * [Roic * (1-f)^n - Wacc]}{Wacc - g} * \frac{1}{(1+Wacc)^T}} \quad \textbf{(15)}$$

where, $f = 1 - \left(\frac{Wacc + S}{Roic}\right)^{\frac{1}{n}}$, (S = permanent spread), and T = n+1

Some interesting papers regarding the Competitive Advantage period are,

- Competitive Advantage Period: The Neglected Value Driver (Mauboussin and Johnson, 1997);
- Sustainable Competitive Advantage in Service Industries: A conceptual Model and Research proposition (Bharadway et al, 1993);

[1] Seen from a business economic and thus an individual company's perspective this sounds logical, but seen from a macro-economic perspective the spread should always tend to zero.

- Rethinking Sustained Competitive Advantage from Human Capital (Benjamin et al, 2012).

Examples:

Approach #1 – Converges to Wacc plus a small spread in the limit

Roic	24,00%
Wacc	12,00%
g	2,00%
Epmin	4,00000%
N	5,00
f (EP)	0,1973

	0	1	2	3	4	5	6
IC	1.000,00	1.020,00	1.040,40	1.061,21	1.082,43	1.104,08	1.126,16
ROIC	24,00%	21,632400%	19,731927%	18,206418%	16,981892%	15,998965%	15,209969%
EP	12,00%	9,632400%	7,731927%	6,206418%	4,981892%	3,998965%	3,209969%
Nopat		240,00	220,65	205,29	193,21	183,82	176,64
Invest		20,00	20,40	20,81	21,22	21,65	22,08
FcF		220,00	200,25	184,48	171,98	162,17	154,56
Roic - EPmin = Wacc		0	0	0	0	0	1
PV		196,43	159,64	131,31	109,30	92,02	78,30
PV							798,71
Total TV	1.565,71						
Equation (14)	1.565,71						

$$V_L = IC_0 + IC_0 * (Roic - Wacc) * \frac{\left[1 - \frac{[(1-f)*(1+g)]^T}{(1+Wacc)^T}\right]}{Wacc - g + f + f*g} + \frac{IC_0 * (1+g)^T * (Roic - Wacc) * (1-f)^n}{Wacc - g} * \frac{1}{(1+Wacc)^T} \quad (14)$$

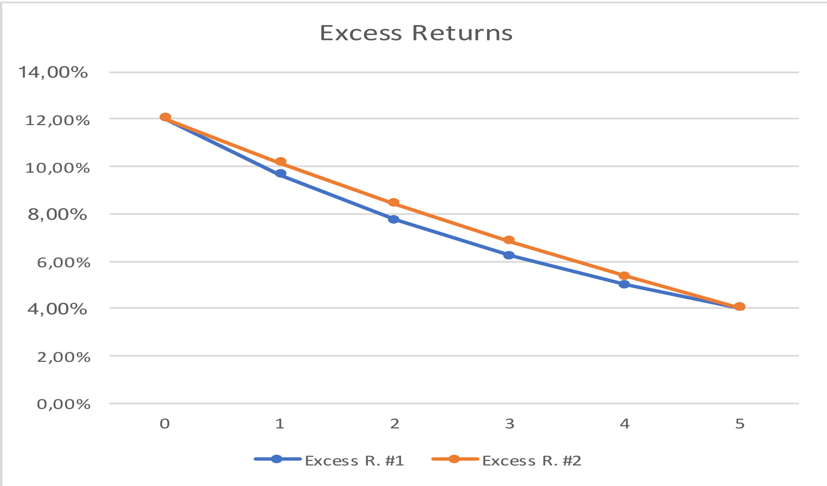
Approach #2 – Becomes Wacc plus a small Spread after a given period

Roic	24,00%		
g	2,00%		
Target Roic*	16,00%	Wacc	12,00%
f	7,79%		
N	5,00		

	0	1	2	3	4	5	6
IC	1.000,00	1.020,00	1.040,40	1.061,21	1.082,43	1.104,08	1.126,16
ROIC	24,00%	22,13%	20,41%	18,82%	17,35%	16,00%	14,75%
Nopat		240,00	225,73	212,31	199,69	187,82	176,65
Invest		20,00	20,40	20,81	21,22	21,65	22,08
FcF		220,00	205,33	191,50	178,47	166,17	154,57
Roic = Wacc		0	0	0	0	0	1
PV		196,43	163,69	136,31	113,42	94,29	78,31
PV		0,00	0,00	0,00	0,00	0,00	798,77
Total TV	1.581,214						
Equation (15)	1.581,214						

$$V_L = IC_0 + IC_0\left[Roic * \frac{\left[1 - \frac{[(1-f)*(1+g)]^T}{(1+Wacc)^T}\right]}{Wacc - g + f + f*g} - Wacc * \frac{\left[1 - \frac{(1+g)^T}{(1+Wacc)^T}\right]}{Wacc - g}\right] + \frac{IC_0 * (1+g)^T * [Roic * (1-f)^n - Wacc]}{Wacc - g} * \frac{1}{(1+Wacc)^T} \quad (15)$$

Difference between approach #1 and #2 (remaining spread):



Differences between the approaches #1 and #2 with and without a remaining spread can be summarized as follows,

	Zero	Spread	Delta
Approach #1	1.113,43	1.565,71	452,28
Approach #2	1.262,10	1.581,21	319,11
Delta	148,68	15,50	
n	5,00		
Spread		4,00%	

Logically, the firm value is higher when a remaining spread is assumed compared to the zero-spread assumption. The difference on a 5 years’ period (time to reach the spread) with a 4% spread is small between both approaches. This difference increases when ***n*** increases or the spread decreases, holding ***n*** constant.

Many analysts conduct a valuation using the Adjusted Present Value approach (APV) because they want to model the capital structure, regarding the forecast period, in more detail, mostly based on a bank covenant. After this forecast period a debt/equity assumption is made and the financing policy strategy, which could be based on “fixed debt”, “fixed ratio” or “mixed policies”. The terminal value is (essentially) based on Wacc-approach essentials where a fixed debt/equity ratio is assumed plus a financing policy strategy, although often executed as an extended APV approach. To assess if a competitive advantage is present, the Wacc and the ROIC must be determined at the end of the forecast period or start of terminal value period. If ROIC is significant higher than Wacc a competitive advantage is most likely applicable and the analyst should determine how long this competitive advantage period will last.

To connect the terminal value, often based on Wacc approach essentials, with the APV approach in the forecast period, the terminal value approach, incorporating a fade-rate structure with or without a remaining spread, must be adjusted.

To determine the terminal value, equations (8) and (11) can be used when no remaining spread after the CAP is assumed, and equations (14) and (15) with a remaining spread. After executing one of these equations, the terminal value levered must divided in the terminal value unlevered plus the terminal value regarding tax shields. The terminal value unlevered and the terminal value regarding tax shields are essential inputs for the APV approach regarding the forecast period and eventually the firm value at valuation date.

This can be done following this procedure,

- First, determine the terminal value levered based on the above-mentioned equations using the predetermined D/E ratio and applicable financing policy;
- Second, determine the terminal value unlevered based on the applicable adjusted terminal value approach;
- Third, subtract the terminal value unlevered from the terminal value levered to get the terminal value tax shields.

To determine the terminal value unlevered equations (8), (11), (14) and (15) must be adjusted. We start with equations (7) and (10). The expected cash flows after the forecast period are annually adjusted based on the fade rate. These adjusted expected cash flow can be used to calculate the terminal value using the cost of equity unlevered as discount rate (like the APV approach). Before adjusting the above-mentioned equations, invested capital at the start of the terminal period ($\boldsymbol{IC_0}$) can't be used and an alternative metric must be found in an unlevered setting. In the case that Wacc is equal to ROIC, then $\boldsymbol{IC_0 = V_{L,0} = \frac{IC_0 * (Wacc - g)}{Wacc - g} = V_u + TS}$[2]. The value unlevered ($\boldsymbol{V_u}$) can be determined using an adjusted version of equation (2). The numerator represents the expected perpetual free cash flows. By discounting these cash flows, the cost of equity unlevered (Ku) can be used to determine the unlevered part of $\boldsymbol{IC_0 = V_{L,0}}$. In the remainder I use the metric $IC_{0,u}$ as the unlevered part of $\boldsymbol{IC_0 = V_{L,0}}$ under the assumption that Wacc is equal to ROIC. This means that,

$$IC_{0,u} = \frac{IC_0 * (Wacc - g)}{k_u - g} \qquad (16)$$

Armed with this equation, equations (8), (11), (14) and (15) can easily be adjusted as follows,

Equation (8):

$$\boldsymbol{V_u = IC_{0,u} + \frac{IC_0 * [Roic - Wacc]}{k_u - g + f + f * g}} \qquad \boldsymbol{(8A)}$$

Equation (11):

$$\boldsymbol{V_u = IC_{0,u} + IC_0 \left[Roic * \frac{\left[1 - \frac{[(1-f)*(1+g)]^T}{(1+k_u)^T}\right]}{k_u - g + f + f * g} - Wacc * \frac{\left[1 - \frac{(1+g)^T}{(1+k_u)^T}\right]}{k_u - g} \right]} \quad \boldsymbol{(11A)}$$

Equation (14):

$$\boldsymbol{V_u = IC_{0,u} + IC_0 * (Roic - Wacc) * \frac{\left[1 - \frac{[(1-f)*(1+g)]^T}{(1+k_u)^T}\right]}{k_u - g + f + f * g} + \frac{IC_0 * (1+g)^T * (Roic - Wacc) * (1-f)^n}{k_u - g} * \frac{1}{(1+k_u)^T}} \quad \boldsymbol{(14A)}$$

Equation (15):

$$\boldsymbol{V_u = IC_{0,u} + IC_0 \left[Roic * \frac{\left[1 - \frac{[(1-f)*(1+g)]^T}{(1+k_u)^T}\right]}{k_u - g + f + f * g} - Wacc * \frac{\left[1 - \frac{(1+g)^T}{(1+k_u)^T}\right]}{k_u - g} \right] + \frac{IC_0 * (1+g)^T * [Roic * (1-f)^n - Wacc]}{k_u - g} * \frac{1}{(1+k_u)^T}} \; \boldsymbol{(15A)}$$

[2] Actually, Invested Capital can't be divided in a unlevered part and a tax shield value. If Wacc=ROIC, the economic value of Invested Capital is equal to the Value levered and thus equal to the Value Unlevered plus the Tax Shield Value. This deduction can be used in this setting.

Using the previous example, the unlevered terminal values and tax shield values can be calculated using the adjusted terminal value equations. The following data are necessary to execute these equations,

Ku	12,15%	
Kd	3,00%	
Tc	25,00%	
D/E	0,25	20,00% Debt Ratio
Ke	14,44%	
Wacc	12,00%	

Regarding the terminal value a 0,25 debt/equity ratio is assumed executing the fixed ratio financing policy. Thus, Wacc is based on the following equation,

$$Wacc = k_u - kd * Tc * \frac{D}{V_L} = 0{,}1215 - 0{,}03 * 0{,}25 * 0{,}2 = 12\% \quad (17)$$

Using equation (16) the unlevered part of invested capital ($\boldsymbol{IC_{0,u}}$) can be calculated as follows,

$$IC_{0,u} = \frac{IC_0 * (Wacc - g)}{k_u - g} = \frac{1000 * (0{,}12 - 0{,}02)}{0{,}1215 - 0{,}02} = 985{,}22 \qquad (16)$$

Approach #1 – Converges to zero in the limit

Executing equations (8) and (8a), the value tax shield can be determined subtracting the value unlevered (8a) from the value levered (8), as presented in the following table,

Value Levered equation (8)	1.113,43
Value unlevered equation (8A)	1.098,49
Value TaxShield	14,94

These values can be checked explicitly as follows,

						n	T	
	0	1	2	3	4	5	6	TV
IC	1.000,00	1.020,00	1.040,40	1.061,21	1.082,43	1.104,08	1.126,16	
Roic	24,00000%	12,73004%	12,04441%	12,00270%	12,00016%	12,00001%	12,00001%	
(R-W)	12,00%	0,73004%	0,04441%	0,00270%	0,00016%	0,00001%		
FcF		220,00	109,45	104,50	106,15	108,24	110,41	112,62
Value U 1)	540,87	forecast period						
Value U 2)	557,62	<---------------	---------------	---------------	---------------	---------------	1.109,52	TV
Value U	1.098,49							
Value L	1.113,43							
TS	14,94							
S 1/1		1.113,43	1.027,04	1.040,84	1.061,24	1.082,43	1.104,08	1.126,16
Wqcc	12,00%	133,61	123,24	124,90	127,35	129,89	132,49	
Fcf		(220,00)	(109,45)	(104,50)	(106,15)	(108,24)	(110,41)	
S 31/12		1.027,04	1.040,84	1.061,24	1.082,43	1.104,08	1.126,16	
Debt 1/1		222,69	205,41	208,17	212,25	216,49	220,82	225,23
Kd * Tc		1,67	1,54	1,56	1,59	1,62	1,66	1,69
							16,64	
TS	14,94	1,67	1,54	1,56	1,59	1,62	18,30	

This means that the value unlevered and the tax shield value (terminal values) are input variables for the APV approach regarding the forecast period and firm value at valuation date.

<u>Approach #2 – Becomes zero after a given period</u>

Executing equations (11) and (11a), the value tax shield can be determined subtracting the value unlevered (11a) from the value levered (11), as presented in the following table,

Value Levered equation (11)	**1.262,10**
Value unlevered equation (11A)	**1.246,59**
Value TaxShield	**15,51**

These values can be checked explicitly as follows,

						n	T	
	0	1	2	3	4	5	6	TV
IC	1.000,00	1.020,00	1.040,40	1.061,21	1.082,43	1.104,08	1.126,16	
Roic	24,00%	20,89%	18,19%	15,83%	13,78%	12,00%	12,00%	
FcF		220,00	192,71	168,43	146,81	127,56	110,41	112,62
Value U 1)	688,97	forecast period						
Value U 2)	557,62	<---------------	---------------	---------------	---------------	---------------	1.109,52	TV
Value U	1.246,59							
Value L	1.262,10							
TS	15,51							
B 1/1		1.262,10	1.193,56	1.144,07	1.112,93	1.099,68	1.104,08	1.126,16
Wqcc	12,00%	151,45	143,23	137,29	133,55	131,96	132,49	
Fcf		(220,00)	(192,71)	(168,43)	(146,81)	(127,56)	(110,41)	
B 31/12		1.193,56	1.144,07	1.112,93	1.099,68	1.104,08	1.126,16	
Debt 1/1		252,42	238,71	228,81	222,59	219,94	220,82	225,23
Kd * Tc		1,89	1,79	1,72	1,67	1,65	1,66	1,69
							16,64	
TS	15,51	1,89	1,79	1,72	1,67	1,65	18,30	

This means that the value unlevered and the tax shield value (terminal values) are input variables for the APV approach regarding the forecast period and firm value at valuation date.

These calculations can be done likewise regarding equations (14), (14a), (15) and (15a), in a setting where a remaining spread is assumed.

A Firm Value perspective

Many analysts using the APV approach to value the firm value at valuation date. This means that they are executing the following equation,

$$V_L = \sum_{t=1}^{\infty} \frac{E(FcF)_t}{(1+k_u)^t} + \sum_{t=1}^{\infty} \frac{E(TS)_t}{(1+k_{ts})^t} \qquad (17)$$

In practice equation (17) is divided in two parts. The value of the forecast period and the terminal value. This means that equation (17) must be adjusted to make this split. This means that,

$$V_L = \underbrace{\sum_{t=1}^{N} \frac{E(FcF)_t}{(1+k_u)^t} + \sum_{t=1}^{N} \frac{E(TS)_t}{(1+k_{ts})^t}}_{\text{Forecast Period}} + \underbrace{\sum_{t=N+1}^{\infty} \frac{E(FcF)_t}{(1+k_u)^t} + \sum_{t=N+1}^{\infty} \frac{E(TS)_t}{(1+k_{ts})^t}}_{\text{Terminal Value}} \qquad (18)$$

It is often assumed that beyond the forecast period cash flows are growing with a constant rate. This can also be the case with tax shield cash flows, depending which financing policy is applied. If the fixed ratio financing policy is executed with a fixed growth rate after the forecast period, equation (18) can be simplified as follows,

$$V_L = \sum_{t=1}^{N} \frac{E(FcF)_t}{(1+k_u)^t} + \sum_{t=1}^{N} \frac{E(TS)_t}{(1+k_{ts})^t} + \left(\frac{E(FcF)_{N+1}}{k_u - g} + \frac{E(TS)_{N+1}}{k_u - g}\right) * \frac{1}{(1+k_u)^N} \qquad (19)$$

To assess whether a significant competitive advantage is present at the end of the forecast period, the analyst should conduct a test where he compares the Roic and Wacc. The Wacc can only be determined when information is present regarding the D/E ratio and financing policy. Executing equation (19) means that a D/E ratio implicitly is used. The way the tax shields are treaded shows the used or assumed financing policy. This means that equation (18) can be adjusted incorporating the assumed D/E ratio and financing policy for the terminal value.

This can be done as follows[3],

$$V_L = \underbrace{\sum_{t=1}^{N} \frac{E(FcF)_t}{(1+k_u)^t} + \sum_{t=1}^{N} \frac{E(TS)_t}{(1+k_{ts})^t}}_{\text{APV}} + \underbrace{\sum_{t=N+1}^{\infty} \frac{E(FcF)_t}{(1+Wacc)^{t-N}}}_{\text{Wacc}} * \frac{1}{(1+Wacc^*)^N} \quad (20)$$

Terminal Value

APV

Presumed:
- changing D/E ratio
- Financing policy

Wacc

Presumed:
- Predetermined D/E ratio
- Financing policy

The terminal value part of equation (20) can be replaced by one of the equations (8), (11), (14) or (15) if the analyst wants to adjust the Roic or the Roic/wacc spread. After executing one of these equations, the outcome must be discounted to the valuation date, using Wacc, for example using equation (8)[4],

$$V_L = \sum_{t=1}^{N} \frac{E(FcF)_t}{(1+k_u)^t} + \sum_{t=1}^{N} \frac{E(TS)_t}{(1+k_{ts})^t} + \left[IC_N + \frac{IC_N * [Roic - Wacc]}{Wacc - g + f + f * g}\right] * \frac{1}{(1+Wacc^*)^N} \quad (21)$$

[3] Wacc* is different from the Wacc due to a different capital structures in the forecast period.

[4] IC_N = invested capital at the start of the terminal period.

If the analyst wants to execute the APV approach in its pure form, equation (20) must be adjusted as follows[5],

$$V_L = \sum_{t=1}^{N} \frac{E(FcF)_t}{(1+k_u)^t} + \left[IC_{N,u} + \frac{IC_N * [Roic - Wacc]}{k_u - g + f + f * g} \right] * \frac{1}{(1+k_u)^N} + \sum_{t=1}^{N} \frac{E(TS)_t}{(1+k_{ts})^t} + \frac{V_{L,TV} - V_{U,TV}}{(1+k_{ts})^N} \quad (22)$$

Although it seems much easier to execute equation (21), in practice, the APV approach in its pure form is mostly executed. One of the disadvantages of the APV approach is that an explicit D/E ratio not is determined and used. Therefore, the long term Wacc must be determined separately based on a thoroughly analysis of the financing policy suitable for the valuation object, which is not often done executing the APV approach.

The long term Wacc should be based on the financing policy suitable for the valuation object. In literature several approaches based on different financing policies are presented, such as[6],

- Fixed ratio financing policy, where tax shields are discounted at the cost of equity unlevered (Ku);
- Fixed debt financing policy without Debt growth, where tax shields are discounted at the cost of debt or the cost of debt plus a small premium, as suggested by Luehrman (1997, HBR);
- Fixed debt financing policy with Debt growth[7], where tax shields are discounted at the cost of debt or the cost of debt plus a small premium;

[5] Using equation (8a).
[6] Ehrhard and Daves (1999) called the fixed ratio the "Compressed" approach, the fixed debt without Debt growth the "Hamada" approach and the fixed debt with Debt growth the "Myers" approach. The "Compressed" approach can also be named as the "Harris & Pringle" approach because they first presented the APV approach based on a fixed ratio financing policy. The mixed approaches are deduced from the above mentioned approaches.
[7] Normally the growth rate is the same as the fixed cash flow growth rate after the forecast period.

- A mixed financing policy, meaning a combination of fixed ratio and fixed debt with an without debt growth.

The Wacc differences between these financing policy approaches can be relatively large. For instance, the Wacc determination based on Fixed ratio and Fixed debt with debt growth can compared as follows,

<u>Wacc based on Fixed Ratio:</u>

$$Wacc = K_u - Kd * Tc * \frac{D}{V_L} \qquad (23)$$

<u>Wacc based on Fixed debt with debt growth:</u>

$$Wacc = K_u - \frac{(K_u - g)}{(Kd - g)} * Kd * Tc * \frac{D}{V_L} \qquad (24)$$

A major difference between equation (23) and (24) is the leverage factor $\left[\frac{(K_u-g)}{(Kd-g)}\right]$; the larger the difference between Ku and Kd, the larger the Wacc difference between the two financing policy approaches and therefore also on the (ROIC-Wacc)-spread.

Conduction a Valuation using a Residual Value Approach

In a valuation much attention is given to the forecast period. Presenting the financial forecast for the forecast period consists of the expected free cash flows plus forecasted balance sheet projections. At the end of the forecast period the expected net operating profit (after tax, or NOPAT) should be in line with the forecasted business model. The invested capital at the end of the forecast period should be in balance as well, meaning that based on this invested capital it is to be expected that the NOPAT can be realized. Before executing a Residual-Value-approach, a proper analyses should be conducted. The following steps can help in analyze the financial forecast and selecting the correct residual value approach.

STEP 1.

Create a peer-group with 'look-alike' companies and conduct a ratio-analysis. Compare the outcome with the Valuation-object. Especially, compare the ROIC of these peer-group companies with the Valuation-object. An importing point of departure is that invested capital should be equal to the economic replacement value or alternatively, the investor could buy the assets in the market for more or less the same price. Large differences could be a sign for a wrong, too optimistic or pessimistic, financial forecast. An extremely high or low ROIC could also be a sign of seasonality. Of course, a high ROIC could also indicate a business model with high value added products or services and thus a high degree of distinctiveness, enabling and achieving higher profits. It is up to the analyst to assess these anomalies and conduct proper actions based on this assessment to get more detailed insights regarding the real profitability and (ROIC-Wacc)-spread of the business model.

STEP 2.

In the case that a high ROIC, resulting in a high spread, is realistic the analyst should assess the Competitive Advantage Period (CAP), the time that the company can benefit from the highly profitable business model. For traditional based companies this CAP is normally shorter than for less traditional based companies, such as technology driven companies with patents or companies with long term valuable distribution contracts.

STEP 3.

After the determination of the CAP, the analyst should decide whether or not there should be a remaining spread, assuming that management is still capable to find profitable investment projects. The analyst has to come up with the size of the remaining spread, if applicable.

STEP 4.

After step 3 the analyst must decide which approach he should use to determine the residual value; approach-base #1 (Holland, 2018) or approach-base #2. In approach #1 the spread declines exponentiality where in approach #2 the spread declines more gradually (linear), implying, keeping the other variables fixed, approach #2 leads to a higher residual value than approach #1.

STEP 5.

After completing the previous 4 steps, the analyst should assess the whole valuation, meaning the forecast period value, the residual value and possible real option values[8].

Closing thoughts

In this short note we discussed two basically different residual value approaches. Approach #1 is based on the Holland-model (2018), where the spread between Wacc and ROIC declines, and approach #2 where ROIC declines towards the Wacc. From a theoretical perspective it is arguable that when NOPAT decreases, the cash flow risks rises[9] and therefore Wacc should rise as well. This means a double effect, a lower ROIC and a higher Wacc. This is incorporated in approach #1 resulting in an exponential decline of the spread. On the other hand, approach #2, just dealing with a decline of the ROIC leaving the Wacc unattached, the decline of the spread is more gradually, and probability more in line with what is to be expected. The lowest invested capital value is equal to the economic replacement value or asset based value which means that, although a small theoretical error is possible due in executing approach #2[10], at the end of the CAP the economic value is tending towards the asset based value.

Eventually it is up to the analyst which approach suits the specific valuation case most.

An importing contribution of this short note is that, besides fundamental attention given to forecast periods in most valuation cases, in this short note tools are given to conduct a thoroughly analysis of the residual value, which is basically a significant large part of the firm value.

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[8] An elaboration on real options is beyond the scope of this short note

[9] This can be seen by showing the following equation, $\sigma_{c\%} = \sigma_{IBR} * \left[1 + \frac{Fixed\ Costs\ (1-Tc)}{E(FcF)}\right]$. When σ_{IBR} and the Fixed Costs remain unchanged, a decline of the expected Free Cash Flow automatically increases the cash flow sigma, often resulting in a higher discount rate.

[10] This is not the case when only systematic risk is relevant and the cash flow decline doesn't effect systematic risk (Scordis et al, 2008).