Implied Cost of Capital: How to Calculate It and How to Use It

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The article discusses the importance of implied cost of capital as a tool capable of guiding choices in valuations based on the income approach and the market approach. In particular, the article suggests the use of implied cost of capital for two main purposes: a) as a test of reasonableness of the cost of capital estimated on the basis of the CAPM and the WACC (MM formula); b) as a test of valuations using multiples. The article consists of three parts: part one highlights the criticalities in the application of the CAPM and the MM formula in the current market context (low risk-free interest rates, unstable beta coefficients, volatile ERPs, risky debt); part two outlines the ways in which implied cost of capital is estimated while part three illustrates the use of implied cost of capital by reference to a listed multinational company (for which it is hard to determine in advance whether the expected return depends on local or global factors, i.e. risk-free rate, ERP and beta) and a listed company operating in the luxury goods sector (to test the reasonableness of the estimate that would be obtained by using multiples).

1. Introduction

Business valuation is founded often on assumptions that tend to become conventional wisdom, also when the context would require critical thinking in their application. In an essay on the role of fundamental analysis in investment activities[1], Lee and So write: "*Assumptions matter. They confine the flexibility that we believe is available to us as researchers and they define the topics we deem worthy of study. Perhaps more insidiously, once we've lived with them long enough, they can disappear entirely from our consciousness*".

Estimation of the cost of capital is the area where the presence of these limitations is clearer. In fact, the estimation of such cost involves two types of choice:

a) identification of the model;

b) selection of the input factors necessary to feed such model.

Regarding the model, the main criterion adopted by professional practice is usually ease of use. This explains why the CAPM is still the most popular model in estimating the cost of equity, despite the extensive criticism levied against it by the academic literature (the beta coefficient is not a good estimator of the expected risk premium). The simplicity of the model overshadows its imprecision as it typically returns reasonable estimates. It might be said that the CAPM is conventionally considered the model of reference to estimate the cost of equity by the business valuer community.

As to the selection of inputs, the benefit of the CAPM is that it only requires three factors: the risk-free interest rate, the Equity Risk Premium (ERP) and the beta coefficient. Even though the factors are interrelated, in practice they are considered as independent of one another. For example, the risk-free interest rate may be assumed to be equal to that prevailing on the valuation date, the ERP might be set as equal to the long-term historical average while the beta coefficient might be calculated on a more recent historical period. If the risk-free rate is inversely related to the ERP and the beta coefficient is a function of the (prospective) ERP, when the estimation of the three factors (risk-free rate, ERP and beta coefficient) fails to take into account their mutual relationships, the estimation error is inevitable. Under normal market conditions, the error is small and the CAPM still returns reasonable estimates of the cost of equity. However, under unusual market conditions, such as those we are experiencing now – with risk-free rates particularly low and a marked instability of the beta coefficients – to obtain reasonable results it is necessary in many cases to normalize the input factors of the CAPM.

Normalization requires always subjective judgment, with considerable scope for discretion. The adoption of a model to estimate the cost of equity (CAPM) whose main benefit is simplicity, followed by discretional and subjective adjustments, not only casts doubt on the result but ends up being a nonsense. For example, when as a result of normalization use is made of input factors substantially different from those cur-

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[1] Charles M. C. Lee, Eric C. So, Alphanomics: the informational underpinnings of market efficiency, *Foundations and Trends in Accounting*, Vol. 9, Nos 2-3, 2014, 59-258.

rently prevailing in the market (suffice to think of the use of long-term average risk-free rates when the current rates are low) one risks violating two of the requirements typical of every valuation that should never be violated, even in the presence of specific facts and circumstances, considering that "value is determined at a specific point in time [2]" and must reflect:

a) current conditions at the valuation date;

b) current expectations of market participants.

Hence the need to have methodologies alternative to the CAPM that might produce estimates that could be used as comparable measures or to supplement and support the results obtained with the CAPM, even though this might be a little hard to do.

In fact, even though the academic literature has had for many years models capable of overcoming certain important limitations of the CAPM (including the Fama French three-factor, and eventually five-factor, model, capable of explaining anomalies that the CAPM does not capture) and professional practice has introduced modifications to the CAPM (including the CAPM build-up approach), such new models are still founded on historical returns that, under unusual market conditions, still require the normalization of input data. This normalization is even harder to apply compared to that required by the CAPM, if nothing else for the greater number of variables to be estimated. As early as August 2010, in the Presidential Address of the American Finance Association entitled "Discount Rates", John Cochrane said [3]: "*In the beginning, there was chaos. Practitioners thought that one only needed to be clever to earn high returns. Then came the CAPM. Every clever strategy to deliver high average returns ended up delivering high market betas as well. Then anomalies erupted, and there was chaos again*" and concluded by stressing the limitations typical of statistic models to estimate the cost of equity: "*Discount rates vary a lot more than we thought. Most of the puzzles and anomalies that we face amount to discount-rate variation we do not understand. Our theoretical controversies are about how discount rates are formed. We need to recognize and incorporate discount-rate variation in applied procedures. We are really only beginning these tasks. The facts about discount-rate variation need at least a dramatic consolidation. Theories are in their infancy. And most applications still implicitly assume i.i.d.* [independent and identically distributed, editor's note] *returns and the CAPM, and therefore that price changes only reveal cashflow news. Throughout, I see hints that discount-rate variation may lead us to refocus analysis on prices and long-run payoff streams rather than one-period returns*".

Hence the growing interest for models to estimate the cost of equity based on expected returns. This is a strand of the academic literature devoted to the implied cost of capital, derived from accounting-based valuation models and developed more than 15 years ago, which only recently has gained currency among practitioners.

The idea underlying this strand of analysis is very simple: assuming that the market is efficient (prices = fundamental values) and that the consensus forecasts of equity analysts (sell side) reflect market (investors') expectations, the expected return (= cost of equity) of a share is equal to the internal rate of return that equates the present value of expected (consensus) cash flows to the current market value of the share. Thus, the estimation of the implied cost of capital uses current prices and consensus expectations, making it possible – for listed companies with adequate analyst coverage – to derive the cost of equity just by reverse engineering valuation formulas, thereby dispensing with the use of historical data (and the resulting need to normalize).

The literature in question has followed two parallel paths centred on the estimation of expected returns for single companies or for company portfolios, with the main difference that, in the former, to calculate the implied cost of capital it is necessary to make assumptions on earnings growth rates beyond the explicit forecast period covered by analysts (long-term growth rate) while, in the latter, no assumption is required as the long-term growth rate and the implied cost of capital (though related to a company portfolio) can be estimated simultaneously through a cross-sectional analysis.

The simplicity of the calculation models and the prospective nature of the implied cost of capital seem to represent the ideal features for its adoption on a large scale. However, the concept is based on two heroic assumptions, in that to express the cost of equity it is necessary that financial markets be fundamentally efficient (prices = intrinsic values) and that analysts' forecasts be not distorted by excessive bullishness (i.e. express stock market expectations). The academic literature has shown that both assumptions do not pass muster. As such, the implied cost of capital is nothing more than the internal rate of return (IRR) of those who base their investment decisions on analysts' forecasts and the current price of a share. For this reason, more than an alternative to CAPM, implied cost of capital is a comparative measure, which is all the more necessary the more current market conditions are unu-

[2] "Value is determined at a specific point in time. It is a function of facts known and expectations made only at that point in time" Howard E. Johnson, *Business Valuation*, Veracap Corporate Finance Limited, 2012, pag. 34.

[3] John H. Cochrane, Discount rates, *The Journal of Finance*, Vol. LXVI, n. 4, August 2011, pag. 1047-1108.

sual, as there is no doubt that it provides useful evidence in the formation of an opinion on the reasonableness of the estimated cost of capital obtained with the CAPM.

Yet the benefits of implied cost of capital go beyond the mere support to the results obtained with the CAPM. In fact, the CAPM is typically used to estimate the cost of equity but, since in most cases (non-financial) business valuations are performed by adopting the enterprise value perspective, the cost of capital considered is the WACC (Weighted Average Cost of Capital), of which the cost of equity is only a part. The estimation of WACC assumes that the leverage ratio, based on market values, is known and introduces a circularity in the estimation of the cost of capital (to find the market value of the company, and to calculate its leverage ratio, it is necessary to know its cost of capital but the cost of capital can be estimated only if the level of debt is known). To overcome this circularity, typically reference is made to the average leverage ratio for the industry (derived from comparable listed companies) and to the Modigliani Miller (MM) model to estimate the weighted average cost of capital. However, both solutions have significant limitations:

a) the financial structure of the company to be valued might be significantly and persistently different from the industry average;

b) estimation of the WACC based on the MM model postulates zero bankruptcy costs (a circumstance predicated upon the existence of risk-free debt, or that the debt beta is zero) while evidence suggests that even companies rated BBB (investment grade) have debt beta coefficients persistently greater than zero.

Despite these limitations, the MM model constitutes the second main approach related to the estimation of the cost of capital (after the CAPM) for the business valuers community[4].

The possibility to calculate the WACC implied in the current measure of enterprise value makes it possible to overcome both the circularity of the estimation of the cost of capital and the limitations of the average target financial structure for the industry and the lack of bankruptcy costs.

Another important benefit of the implied cost of capital concerns multinational companies. Typically, to estimate the cost of capital with the CAPM, the risk-free rate is estimated on the basis of the yields on long-term government bonds of the country where the company is headquartered. In the case of multinational enterprises, this solution is not practicable. Two companies that compete in the same markets on a global basis, which are exposed to the same risks and use the same functional currency (e.g. the euro), should always be valued on the basis of the same cost of capital, regardless of the country where they are headquartered (e.g. Germany or Greece), even though the yield spreads between their respective government bonds of the two countries are wide.

Lastly, the implied cost of capital can be used to check the consistency between the estimates derived from both the market approach and the income approach. Valuations based on multiples of comparable companies rest on a careful selection of peers. In particular, the company undergoing valuation should exhibit risk profiles and growth prospects similar to those of the selected comparable companies. The implied cost of capital can provide an indication of the quality of this selection. In fact, if the selection is done properly, the implied cost of capital in the value estimated through multiples (that is by applying to the company undergoing valuation the multiple considered appropriate, as derived from the comparable companies) and in the income streams utilized in the income approach should be aligned with the cost of capital used in the income approach (CAPM and WACE).

The main practical limitation of the implied cost of capital is that it can be calculated only for listed companies with adequate analyst coverage. However, this limitation is not more stringent than that of the CAPM, where in any case it is necessary to identify listed companies comparable to the subject of the valuation from which an estimation of the beta coefficient can be derived.

This article discusses the ways in which the implied cost of capital can be estimated and analyses its possible different uses. The article is structured in 3 chapters. Chapter 2 illustrates briefly the limitations of the CAPM in the current market conditions. Chapter 3 outlines the main methods of estimation of the implied cost of capital (which valuation model, which market price, enterprise value or equity value perspective etc.). Finally, chapter 4 describes two different

[4] In fact, paragraph 50.30 of International Valuation Standard (IVS) 105 "Valuation approaches and methods" states:

"50.30. *Valuers may use any reasonable method for developing a discount rate. While there are many methods for developing or determining the reasonableness of a discount rate, a non-exhaustive list of common methods includes:*

(a) the capital asset pricing model (CAPM),

(b) the weighted average cost of capital (WACC),

(c) the observed or inferred rates/yields,

(d) the internal rate of return (IRR),

(e) the weighted average return on assets (WARA), and

(f) the build-up method (generally used only in the absence of market inputs)".

CAPM and WACC (MM model) rank first and second, respectively, on the list but the third approach on the list is that based on observed or inferred rates/yields, i.e. implied cost of capital.

practical estimations of the implied cost of capital of two different listed companies.

2. Practical limitations of the CAPM and the MM formula in the current market conditions

A few facts and figures will suffice to grasp the main difficulties in applying the CAPM in the current market context.

The first difficulty is the estimation of the risk-free rate. Table 1 shows the risk-free rates related to four main currencies (Euro, Pound sterling, US dollar and Japanese yen) for the past three years (the table shows data points at 31 December of each year as well as the one-year, three-year and five-year averages as of 31 December 2017). The table shows that the three-year and five-year averages are much higher than the risk-free rates prevailing on 31 December 2017 (except for the U.S.). Furthermore, the table shows that the ten-year government bond yields of the different countries of the euro area differ substantially. This makes it difficult to choose the most appropriate risk-free rate. Certain valuers prefer to use the 10-year Interest Rate Swap while others adopt the rate of the country where the company is headquartered.

Table 1: Risk-free rate and ERP

A) Risk-free rate (source: FactSet)

	Government Benchmark Bond 10Y								
	EURO Area					UK Pound	Factset - Weighted Average	USD	Yen
	Germany	France	Italy	Spain	IR Swap 10Y	United Kingdom		United States of America	Japan
31.12.2017	0,43%	0,77%	1,98%	1,54%	0,90%	1,19%	0,82%	2,43%	0,04%
31.12.2016	0,20%	0,69%	1,82%	1,40%	0,65%	1,09%	0,71%	2,48%	0,04%
31.12.2015	0,63%	1,00%	1,59%	1,76%	1,00%	1,95%	1,15%	2,30%	0,26%
Mean 1Y	0,37%	0,81%	2,07%	1,56%	0,82%	1,20%	0,83%	2,33%	0,05%
Mean 3Y	0,34%	0,71%	1,73%	1,56%	0,74%	1,40%	0,83%	2,10%	0,12%
Mean 5Y	0,77%	1,19%	2,47%	2,39%	1,12%	1,80%	1,30%	2,23%	0,32%

B) Implied ERP (source: FactSet)

	ERP - implied in Stoxx 600	ERP - implied in S&P 500
2017	4,10%	2,88%
2016	4,54%	3,51%
2015	4,45%	4,41%
Mean 1Y	4,46%	3,45%
Mean 3Y	4,84%	4,21%
Mean 5Y	4,81%	4,47%

C) Historical ERP (source: Credit Suisse Global Investment Returns Sourcebook, 2018)

	Historical ERP (1900-2017) vs. Long Term Governments Bonds						
	Germany	France	Italy	Spain	United Kingdom	United States of America	Japan
Geometric Mean	5,10%	3,10%	3,20%	1,80%	3,70%	4,40%	5,10%
Artithmetic Mean	8,40%	5,40%	6,50%	3,80%	5,00%	6,50%	9,10%

The choice of the risk-free rate does affect also the choice of the Equity Risk Premium (ERP). For example, the database Factset derives the ERP implied in the Stoxx 600 index (whose constituents are companies of the Euro area, United Kingdom, Scandinavia and Switzerland) on the basis of a weighted average risk-free rate for the Euro and the other currency areas. Then, the implied Stoxx 600 ERP is expressed net of the average country risk of the two currency areas (Euro and Pound sterling) taken as a whole. On the other hand, if use is made of historical ERP measures, it would be necessary to consider that such measures are calculated as the arithmetic or geometric mean of the differences between equity returns in each country and long-term government bond yields for the same country (thus inclusive of the specific country risk). In this case, the ERPs are already net of the specific country risk.

The Equity Risk Premium and the risk-free rate combine to determine the overall stock market return (Rm). The composition of the stock market return, however, is not neutral. Given the same market return (Rm), a higher ERP entails a greater cost of equity. Table 1 shows the ERPs implied in the Stoxx 600 and in the S&P 500 indices as well as the historical long-term ERPs for the same countries for which the risk-free rate is indicated. The table reveals, for example, that the calculation of stock market returns as the sum of government bond yields prevailing on 31 December 2017 and the arithmetic mean of historical ERP would return unreasonable results. To see that, it is enough to compare the data related to Germany and Italy, two countries of the Euro area. In fact:

i. Germany's stock market return (Rm) would be 8.83% (= 0.43% + 8.40%), which is higher than the Italian stock market return calculated with the same methodology (8.48% = 1.98% + 6.50%), while one might be forgiven for doubting that an investor would require a return on an investment in Italian equities lower than that for an investment in German equities, when the same investor does require a premium of 145 bps (= 1.98% – 0.43%) on Italian government bonds;

ii. the difference between expected returns on aggressive shares (beta>1) would be even greater. An Italian share with a beta of 1.5 should provide a return of at least 11.73% whereas a German share with the same beta should return 13.03% (delta = 130 bps.).

Table 2 shows as an example three different options to estimate Italian market returns (considering only the data points at 31 December 2017) and the resulting estimated returns of two hypothetical shares (Ri), with a respective beta of 1.5 and 0.5 (limits of the normal distribution range of the beta coefficients). The table shows that the estimated market returns could range between 5.18% and 8.48%, the returns on the aggressive share (beta = 1.5) between 6.78% and 11.73% while the returns on the defensive share between 3.58% and 5.23%. It is clear that these differences are too broad and unreasonable.

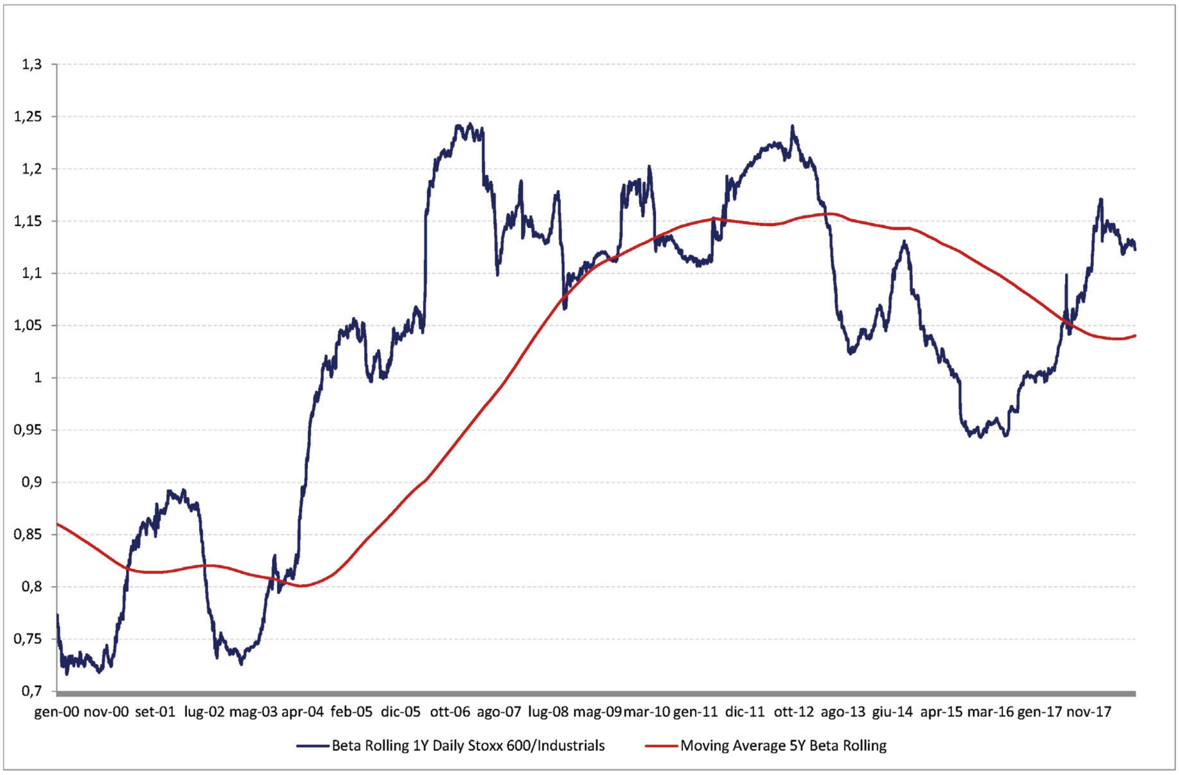
Table 2: Different options for estimating the expected return of the market and of aggressive stock and defensive stock

					Ri		
	Rf (a)	Country risk premium (b)	ERP ©	Rm (d = a+b+c)	Beta = 1,5	Beta = 0,5	delta
Option 1	Gov. Bond Italy 10Y 1,98%	n.m.	Historical Geometric Mean 3,20%	**5,18%**	6,78%	3,58%	3,20%
Option 2	Facset weighted average 0,82%	(Gov. Bond Italy 10Y - Facset weighted average Gov. Bond 10Y) = 1,98%-0,82% = 1,16%	Implied in Stoxx 600 4,10%	**6,08%**	8,13%	4,03%	4,10%
Option 3	Gov Bond Italy 1,98%	n.m.	Historical Aritmetic Mean 6,50%	**8,48%**	11,73%	5,23%	6,50%

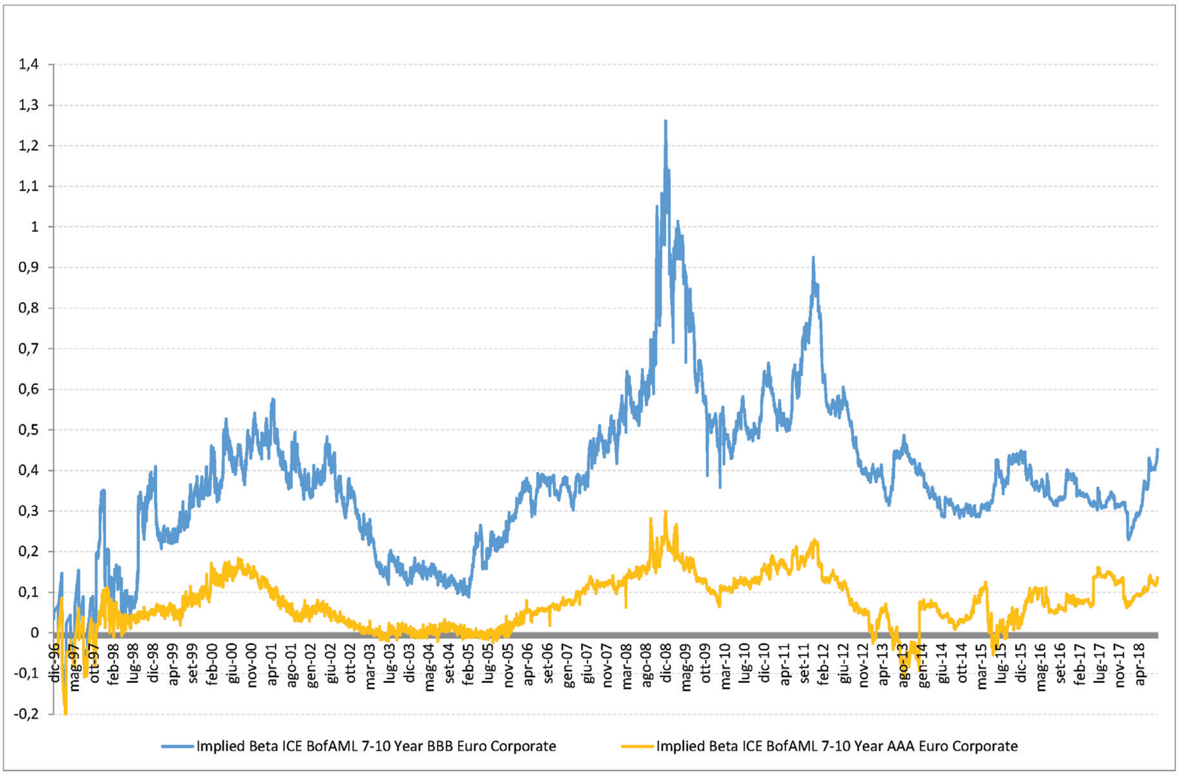
Further complications arise when the beta coefficients are estimated. Graph 1 illustrates changes in the beta coefficients of the shares of the companies included in the Stoxx 600 Industrials, as calculated on the basis of daily rolling returns over a one-year period and the 5-year moving average of the same beta coefficient. It can be seen that the beta coefficient is highly volatile over time.

Lastly, graph 2 shows the beta coefficient of BBB and AAA corporate bonds of the Euro area, with a maturity ranging from 7 to 10 years. It can be seen that BBB bonds feature a beta systematically higher than zero and a high volatility over time.

Graph 1: Stoxx 600/Industrial: Beta Rolling 1Yrs daily and Moving Average 5Yrs



Graph 2: Beta 7-10 Yrs BBB and AAA Euro Corporate



Overall, this shows the scope for discretion of the business valuer in estimating the cost of equity. The simple reference to the CAPM to estimate the cost of equity and the MM model to estimate the WACC do not guarantee the outer limits of a reasonably restricted range of the estimates of the cost of equity. Hence the need for supporting evidence.

3. Implied cost of capital: Estimation methods

The implied cost of capital is not a quantity defined with certainty but, like the cost of equity of the CAPM, it needs to be estimated. Even though the scope for discretion in estimating the implied cost of capital is more limited, compared to that which characterizes the choice of inputs in estimating the cost of equity on the basis of the CAPM, it is still a good idea to analyse it. It concerns three main choices:

a) the valuation method to be used to extract the implied cost of capital;

b) the market price to be used;

c) the growth rate to estimate terminal value.

Let's analyse them separately.

A) Valuation method

The selection of the valuation method entails in turn two choices:

i. the method (DCF or Residual Income Model-RIM or Abnormal Earnings Growth Model-AEGM);

ii. the valuation perspective (enterprise value or equity value).

The choice of the valuation method

The valuation method to be used to extract the implied cost of capital does not have to be necessarily the same as that used by equity analysts to estimate the intrinsic value of the share. This for two main reasons:

1) analysts' forecasts extend for a limited number of years and the consensus does not provide any guidance on the results to be projected beyond the explicit forecast period to calculate terminal value;

2) analysts' forecasts concern typically the main income statement items and the metrics necessary to estimate cash flows (capex, changes in working capital and dividends), which make it possible to use, in addition to cash-based methods (DCF and DDM), also accounting-based methods (RIM and AEG) with their lower emphasis on terminal value.

An example can clarify this aspect. Let's consider the comparison between RIM and DCF from an equity value perspective (= DDM = Dividend Discount Model).

Suppose that the market capitalization of company X is € 864.5 million. Suppose also that analysts' five-year consensus forecasts of net income (NI) and dividends are available and that it is reasonable to project an earnings growth rate beyond the explicit forecast period (g) of 3%. Lastly, let the book value of equity at the valuation date be € 700 million.

Table 3: X Co.: RIM, DDM and AEG: calculation of terminal value and implied cost of capital

		1	2	3	4	5	TV	
NI		100	105	118	122	130		
Dividends		2	3	3	4	4		
Book value (at the begininning of the year)		700	798	900	1015	1133		
Book value (at the end of the year)		798	900	1015	1133	1259		
g	3%							
cost of equity (coe)	10,0%							
RIM								
RI = NI - coe x BV_{-1}		30	25,2	28	20,5	16,7		
NI $_{year\ 6}$ = NI $_{year\ 5}$ x (1+g)							133,9	
RI $_{year\ 6}$							8,0	= RI $_{year\ 6}$ is not RI $_{year\ 5}$ x (1+g)
TV							114,2857	
Discount factor		0,909	0,826	0,751	0,683	0,621		
PV(RI)		27,3	20,8	21,0	14,0	10,4	71,0	
Sum of PV(RI)	164,5							
BV	700							
Equity value	864,5							
DDM								
BV $_{year\ 6}$ = BV $_{year\ 5}$ x (1+g)							1296,8	
Dividends		2	3	3	4	4		
Dividends $_{year\ 6}$ = NI $_{year\ 6}$ - (BV $_{year\ 6}$ - BV $_{year\ 5}$)							96,1	= Div $_{year\ 6}$ is not Div $_{year\ 5}$ x (1+g)
TV							1373,3	
Discount factor		0,909	0,826	0,751	0,683	0,621		
PV(Dividends)		1,8	2,5	2,3	2,7	2,5	852,7	
Equity value	864,5							
Wrong RIM								
RI		30	25,2	28	20,5	16,7		
RI $_{year\ 6}$ = RI $_{year\ 5}$ x (1+g)							17,2	
TV							245,7	
PV(RI) @10%		27,3	20,8	21,0	14,0	10,4	152,6	
Sum of PV(RI)	246,1							
BV	700,0							
Equity value	946,1							
implied coe	10,5%							
Wrong DDM								
Dividends		2	3	3	4	4		
Dividends yaer 6 = Dividends year 5 x (1+g)							4,1	
TV							58,9	
PV(Dividends) @10%		1,8	2,5	2,3	2,7	2,5	36,5	
Equity value	48,3							
implied coe	3,40%							
AEG								
Cum dividend earnings = NI + (Div_{-1} x coe)			105,06	118,09	122,09	130,12	134,3	
normal earnings = NI_{-1} x coe			110	115,5	129,8	134,2	143	
AEG			-4,94	2,59	-7,71	-4,08	-8,7	
AEG/coe			-49,4	25,9	-77,1	-40,8	-87	
TV = (AEG $_{year\ 6}$ x (1+g)/coe)/(coe - g)								-1280,1
Discount factor		0,909	0,826	0,751	0,683	0,621		
PV(AEG/coe)			-44,9	21,4	-57,9	-27,9	-54,0	-794,9
Sum of PV(AEG/coe)	-958,2							
NI/Coe	1000							
Equity value	41,8							
implied coe in market cap	3,4%							

Table 3 shows how the streams of results at the basis of the calculation of terminal value in the two valuation models (RIM and DDM) should be estimated on the basis of consensus forecasts, so that they might return equal results. In particular[5]:

1) regarding the RIM: given the earnings growth rate

[5] For a more in-depth discussion on the method to estimate income streams/cash flow in the terminal year, see Russell Lundholm, Terry O'Keefe, Reconciling value estimates from the Discounted cash Flow Model and the Residual Income Model, *Contemporary Accounting Research*, vol. 18, No 2, 2001, pp. 311-35.

beyond the explicit consensus forecast horizon (g), the Residual Income to estimate terminal value (year 6) is as follows:

$\text{Residual Income}_{\text{year 6}} = \text{Net Income}_{\text{year 6}} - \text{cost of equity} \times \text{Book Value}_{\text{at the end year 5}}$

where:

$\text{Net Income}_{\text{year 6}} = \text{Net Income}_{\text{year 5}} \times (1 + g)$,

thus:

$\text{Residual Income}_{\text{year 6}} \neq \text{Residual Income}_{\text{year 5}} \times (1 + g)$

2) regarding the DDM: the dividend to estimate terminal value (year 6) is as follows:

$\text{Dividends}_{\text{year 6}} = \text{Net Income}_{\text{year 6}} - (\text{Book Value}_{\text{at the end year 6}} - \text{Book Value}_{\text{at the end year 5}})$

where:

$\text{Book Value}_{\text{year 6}} = \text{Book Value}_{\text{year 5}} \times (1 + g)$,

thus:

$\text{Dividends}_{\text{year 6}} \neq \text{Dividends}_{\text{year 5}} \times (1 + g)$

The adoption of these residual-income and dividend values to estimate terminal value results in the same equity value with both valuation models, so that by setting equity value as equal to market capitalization and tracing our way back through the valuation, the same implied cost of capital is obtained (in the example it is 10%).

However, if to estimate terminal value use had been made of the values obtained on the basis of the following (wrong) relationships, which are still used frequently:

$\text{Residual Income}_{\text{year 6}} = \text{Residual Income}_{\text{year 5}} \times (1 + g)$

$\text{Dividends}_{\text{year 6}} = \text{Dividends}_{\text{year 5}} \times (1 + g)$

the result would have been distorted estimates of implied cost of capital and the distortion would have been significantly greater if the DDM had been applied.

Table 3 shows also the calculation based on the wrong estimates of terminal value. The table shows first how, by making use of wrong streams of results to be projected beyond the explicit forecast period, the equity value that would be derived from the two models (RIM and DDM) by adopting a cost of capital of 10% would be greater than current enterprise value of company X's (946.1 vs. 864.5), in the case of RIM, and significantly lower (48.4 vs. 864.5), in the case of DDM.

By the same token, by tracing our way back through the two models, after setting the equity value equal to market capitalization, the implied cost of capital would be significantly different from each other and different from the effective implied cost of capital (which in the example is equal to 10%). In fact:

– in the case of RIM, the implied cost of capital would be higher than 10% (and equal to 10.5%, with an error of + 0.5%);

– in the case of DDM, the implied cost of capital would be lower than 10% (and equal to 3.4%, with an error of – 6.6%).

The example in table 3 casts light on four significant aspects[6]:

a) even with a complete set of consensus information (earnings and dividend forecast and growth rate beyond the explicit forecast horizon), a wrong estimate of implied cost of capital is still a possibility, due to the wrong estimate of last year's stream of results to be projected in perpetuity;

b) the size of the error is typically greater in the DDM than in the RIM, simply because the DDM puts greater weight on terminal value, while in the RIM model terminal value acts as an adjustment factor of the book value of the initial equity;

c) the size of the DDM's error is inversely related to the pay-out ratio (the lower the pay-out, the greater the error in estimating the terminal stream of results obtained by applying the growth rate g to the dividend of the last year of the explicit forecast)[7];

d) the proper application of the DDM requires the same information as the RIM (in particular, it is necessary to have earnings and equity growth forecasts) and, as such, it is not, in practical terms, a model that uses fewer data inputs but only a model more exposed to possible estimate errors.

These elements explain why ample preference is given to the RIM in the literature, compared to the DDM, in estimating the implied cost of capital, even though the RIM is used much less frequently than the DDM by analysts[8] (the RIM is normally applied to companies in regulated sectors to estimate enterprise value – given that their invested capital is equal to RAB _ Regulatory Asset Base – and to financial companies, to estimate equity value, given that equity is represented by regulatory capital).

However, even the RIM has a noticeable limitation. In fact, it is based on the clean surplus assumption, whereby any change in equity between two years is equal to retained earnings, as per the following formula:

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[6] The considerations made for DDM and RIM, from the equity value perspective, apply also to DCF and RIM but from the enterprise value perspective.

[7] If anything, for dividends equal to zero, for any growth rate g, the dividend stream to be utilized to estimate terminal value is always equal to zero.

[8] Richardson S., Tuna I. and Wysocki P., 'Accounting anomalies and fundamental analysis: A review of recent research advances', *Journal of Accounting and Economics*, 2010, vol. 50, issue 2-3, 410-454: "*Table 1 Q6: Over the last 12 months how often have you used the following valuation techniques in your work? Practitioner: RIM Infrequently (46%); Academic Frequently (71%")*.

BV $_{\text{at the end of the year}}$ = BV $_{\text{at the beginning of the ye}}$ (NI – Dividends)

In this case the assumption is that net income is the same as comprehensive income and that the company did not carry out any equity-related transactions (issue of new shares or buyback of own shares)[9].

To overcome the limitation of the RIM, use has been made in the literature of the AEG model. The theoretical benefit of the AEG is that it is not founded on the clean surplus assumption. On the other hand, the AEG has a significant practical limitation, in that often it is not compatible with earnings growth forecasts beyond the explicit forecast period utilized by analysts. This is the case also of company X. Table 4 illustrates the application of the AEG to company X on the basis of the same earnings, dividend and growth forecasts beyond the explicit forecast period shown previously. The earnings growth rate beyond the explicit forecast period (g = 3%) significantly lower than the product of the retention ratio in year 5 (b = 96%) by the cost of equity (coe = 10%) is indicative of negative abnormal earnings which, projected in perpetuity at a growth rate g, give a highly negative terminal value that lowers the estimated equity value. Consequently, the implied cost of capital that would be derived from the use of the AEG model would be 3.4% (the same that would be obtained by applying the wrong formula to estimate terminal value in the case of the DDM) and the error in the estimation with respect to the correct implied cost of capital (= 10%) would be equal to 6.6% (= 10% – 3.4%)

Thus, the AEG model has the same significant practical limitations as the DDM. As such, the RIM is the most suitable model to extract the implied cost of capital. Typically, the RIM is applied:

a) on a per share basis, that is by considering the price per share (instead of market capitalization) and earnings per share (so as to offset the effects of capital increases or share buybacks);

b) in the absence of non-neutral equity-related transactions which, with their dilutive effects or their above-market prices, distort the results of valuations;

c) on the assumption that expected comprehensive income is the same as the net income expected by equity analysts.

<u>The valuation perspective (enterprise value or equity value)</u>

The choice of the valuation perspective is a function of the type of implied cost of capital sought. To this end, there are three types of implied cost of capital:

– cost of equity (coe): this is obtained by using the market value of equity and net income. In this case, the cost of capital is a function of the level of indebtedness of the specific company whose market capitalization is used to extract the implied cost of capital;

– weighted average cost of capital (WACC): this is obtained by using enterprise value (which reflects the sum of the market value of equity and the book value of net debt) and net operating income after taxes. In this case, assuming that the debt's market value is equal to its book value, WACC is computed without the need to estimate the cost of debt or the target financial structure;

– unlevered cost of capital: this is obtained by using enterprise value net of the tax benefits on debt estimated on the basis of the Modigliani Miller model and net operating income after taxes (Nopat). In this case – assuming that the debt's market value is equal to its book value and that there are no bankruptcy costs, so that the Modigliani Miller relationship:

EV $_{\text{unlevered}}$ = EV $_{\text{levered}}$ – Tax shields on Debt applies,

where:

Tax shields on debt = Debt × T_c with T_c = corporate tax rate

an estimate of the cost of capital can be derived to be adapted to the particular financial structure of the company to be valued on the basis of the well-known Modigliani Miller relationship whereby:

WACC = unlevered cost of capital × (1 – T_c B/EV).

Tables 4 and 5 show the calculation of implied WACC and implied unlevered cost of capital by using the DCF and the RIM, respectively, for a hypothetical listed company Y, of which complete consensus forecasts (EBIT and Unlevered Free Cash Flow for the next five years as well as the growth rate of both EBIT and invested capital beyond the explicit forecast period (g = 2%) are available. Company Y's current market capitalization is € 627.6 million and its current debt is € 320 million [for a total enterprise value (EV) = 627.6 + 320 = 947.6 million euros]. The implied WACC and the implied unlevered cost of capital are obtained by reverse engineering the two models. The streams of results underlying the estimation of terminal value are calculated in a manner consistent with one another, on the basis of the same relationship shown previously (table 1). The implied WACC is 10% and the implied unlevered cost of capital is 10.9%.

[9] RIM can be applied also on a per share basis, where the assumption is that any equity-related transaction has no effect on the share value (or that any such transaction is settled at a price equal to the value per share).

Table 4: Y Co.: RIM asset side and implied cost of capital (wacc and unlevered coc)

years		1	2	3	4	5	TV	g
Invested Capital (at the beginning of the year)		700	708	721	735	750	762	
Ebit		100	110	119	129	144		
Tax rate	30%							
Nopat		70	77	83,3	90,3	100,8	102,8	2,0%
Depreciation & Amortization		20	20	21	22	25		
Capex		25	25	25	25	25		
Increase in NWC		3	8	10	12	12		
UFCF		62	64	69,3	75,3	88,8	87,6	
Invested Capital (at the end of the year)		708	721	735	750	762	777,2	2,0%
g	2%							
Implied wacc	10,0%							
Residual Income $_{1\text{-}5}$		0	6,2	11,2	16,8	25,8	26,6	
Discount factor		0,909	0,826	0,751	0,683	0,621		
PV(Residual Income $_{1\text{-}5}$)		0,0	5,1	8,4	11,5	16,0		
Sum PV(Residual Income $_{1\text{-}5}$)	41,0							
TV (RI)							332,7	
PV(TV)	206,6							
Invested capital (at the beginning of the year)	700							
EV	947,6							
Net debt	320							
Market cap	627,6							
Tax shield on Debt = Net debt x TC	96							
Unlevered EV = EV - Tax shield on Debt	851,6							
Implied Unlevered cost of capital	10,9%							

Table 5: Y Co.: DCF asset side and implied cost of capital (wacc and unlevered coc)

years		1	2	3	4	5	TV	
Ebit		100	110	119	129	144		
Tax rate	30%							
Nopat		70	77	83,3	90,3	100,8		
Depreciation & Amortization		20	20	21	22	25		
Capex		25	25	25	25	25		
Increase in NWC		3	8	10	12	12		
UFCF		62	64	69,3	75,3	88,8	87,6	UFCF consistent with RI (table 2)
g	2%							
Implied wacc	10,0%							
Discount factor		0,909	0,826	0,751	0,683	0,621		
PV(UFCF$_{1\text{-}5}$)		56,4	52,9	52,1	51,4	55,1		
Sum of PV(UFCF$_{1\text{-}5}$)	267,9							
TV							1094,7	
PV(TV)	679,7							
EV	947,6							
Net debt	320							
Market cap	627,6							
Tax shield on Debt = net Debt x Tax rate	96							
Unlevered EV = EV - Tax shield on debt	851,6							
Implied unlevered cost of capital	10,9%							

Table 6 illustrates the calculation of the implied cost of equity of company Y from the equity value perspective (in this case also the interest expense and net debt forecasts are available) by using not only the RIM and the DDM but also the AEG. The streams of results reflect the funds available only to the shareholders and the implied cost of equity is obtained as the internal rate of return of an investment that assumes market capitalization as the initial outflow. The table brings to the fore two significant aspects:

i. the growth rate of net income (2.67%) is higher than the growth rate of net operating income after taxes (2%);

ii. the weighted average cost of capital (WACC) and the unlevered cost of capital that would be derived by applying the Modigliani Miller formulas – i.e.

WACC = cost of debt × (1- Tc) × B/EV + cost of equity × Equity/EV

and

unlevered cost of capital = WACC/[(1-Tc × B/EV)]

are different from the implied WACC (9.7% vs. 10%) and the implied unlevered cost of capital (10.75% vs. 10.87%) derived analytically in tables 2 and 3.

Table 6: Y Co.: Implied cost of equity: RIM, DDM and AEG

years		1	2	3	4	5	TV	g
Ebit		100	110	119	129	144		
Interests (Net debt at the beginning of the year x cost of debt)		16	15	15	15	15		
Ebt		84	95	104	114	129		
Tax rate	30%							
NI		58,8	66,5	72,8	79,8	90,3	92,7	2,67%
Dividends		31	54	59	65	78	80	2,67%
Depreciation and Amortization		20	20	21	22	25		
Ebitda		120	130	140	151	169		
Net Debt (at the beginning of the year)		320	300	300	300	300	300	0%
Leverage (Net Debt/Ebitda)		2,67	2,31	2,14	1,99	1,78		
Invested capital (at the beginning of the year)		700	708	721	735	750	762	2%
Book value of equity (at the beginning of the year)		380	408	421	435	450	462	2,67%
Increase in Book value			28	13	14	15	12	
DDM								
Dividends		30,8	53,5	58,8	64,8	78,3	80,4	
Implied Cost of equity	12,8%							
Discount factor		0,887	0,786	0,697	0,618	0,548		
PV(Dividends)		27,3	42,0	41,0	40,0	42,9		
Sum of PV(Dividends)	193,2							
TV							793,1	
PV(TV)	434,3							
Equity value	627,5							
Net Debt	320							
EV	947,5							
RIM								
Residual income		10,2	14,3	18,9	24,1	32,7	33,6	
PV(RI)		9,0	11,2	13,2	14,9	17,9		
Sum of PV(RI)	66,2							
TV							331,1	
PV(TV)	181,3							
Book Value	380							
Equity value	627,5							
Net Debt	320							
EV	947,5							
AEG								
Cum Dividend earnings			70,4	79,6	87,3	98,6	102,7	
Normal earnings			66,3	75,0	82,1	90,0	101,9	
AEG			4,1	4,6	5,2	8,6	0,9	0,9
AEG/coe			32,1	36,2	40,7	67,0	6,8	
TV								69,0
PV(AEG)			28,5	28,5	28,3	41,4	3,7	
Sum of PV(AEG)	130,4							
PV(TV)	37,8							
NI/coe	459,3							
Equity value	627,5							
Net debt	320,0							
EV	947,5							
Wacc and unlevered cost of capital								
Cost of debt	5%							
Cost of debt after taxes	3,5%							
Weight of debt	34%	= 320/947,5						
Weight of equity	66%	0,66						
Implied Cost of equity	12,8%							
wacc	9,7%	= 3,5% x 34% + 12,8%x 66%						
unlevered cost of capital	10,75%	= 9,7%/[(1-Tc x 34%)]						
implied wacc (analitical calculation tables 2 and 3)	10,00%							
implied unlevered cost of capital (analitical calculation tables 2 and 3)	10,87%							

The effects under both i) and ii) are due to the fact that company Y's leverage is not constant. In fact, the example considers stable interest expense and net debt, in the presence of growing unlevered streams. A constant leverage (thus net income streams growing at the same rate as unlevered net income streams) is based on the principle that interest expense on debt increases at the same rate as unlevered net income (and, given the same cost of debt, this means that debt increases at the same rate). Thus, if debt is constant:

i. the growth rate of net income is necessarily higher than the growth rate of unlevered net income;

ii. implied WACC and implied cost of capital cannot be equal to the corresponding metrics calculated with the MM formulas, as such formulas assume a constant leverage. If the leverage ratio falls in relative terms (constant debt and growing unlevered net income) the MM formulas end up making an error.

B) The price to be used

Estimation of the implied cost of capital assumes consistent price and analysts' forecasts. To that end, the choices concern:

a) the use of either an average market price or an actual price;

b) the use of either market prices or target prices;

c) the use of "asymmetrical" analyst forecasts.

Use of either an average price or an actual price

To express the internal rate of return, the implied cost of capital must be calculated by avoiding a misalignment between prices and forecasts. This might be difficult, as prices are more volatile than forecasts and forecasts are updated slowly[10]. Consequently, any price variation not met by a variation in the analysts' consensus entails a change in the implied cost of capital in the opposite direction and to an extent proportionate to the duration of the share.

Table 7 compares the error in the estimation of implied cost of capital of two hypothetical listed companies: company Y (the same as in table 4) and company Z, each with its own equity duration. Both companies have the same market capitalization but company Z has higher expected dividends in the explicit forecast period (shorter equity duration). The table shows that for a 15% decrease of market capitalization, not accompanied by a revision of earnings and dividends by analysts, company Y's implied cost of equity rises from 12.8% to 14.4% (= 14.4%/12.8% – 1 = + 12.5%), while company Z's implied cost of capital increases at a lower rate, from 12.8% to 14% (= 14%/ 12.8% – 1 = 9.4%).

[10] In the literature this is called sluggishness. Guay W. S. Kothari and S. Shu Properties of implied cost of capital using analysts' forecasts, Working paper, University of Pennsylvania, Pennsylvania, Wharton School, 2005.

Table 7: Y Co and Z Co: same market capitalization different equity duration

years		1	2	3	4	5	TV	g
Y Co.: DDM (market cap = 627,5)								
Dividends		30,8	53,5	58,8	64,8	78,3	80,4	
Implied Cost of equity	**12,8%**							
g	2,67%							
Discount factor		0,887	0,786	0,697	0,618	0,548		
PV(Dividends)		27,3	42,0	41,0	40,0	42,9		
Sum of PV(Dividends)	193,2							
TV							793,1	
PV(TV)	434,3							
Equity value	627,5							
Y Co.: DDM (market cap = 627,5 x (1 - 15%) = 533,4								
Dividends		30,8	53,5	58,8	64,8	78,3	80,4	
Implied Cost of equity	**14,4%**							
g	2,67%							
Discount factor		0,874	0,764	0,668	0,583	0,510		
PV(Dividends)		26,9	40,9	39,3	37,8	39,9		
Sum of PV(Dividends)	184,8							
TV							683,8	
PV(TV)	348,6							
Equity value	533,4							
Z Co.: DDM (market cap = 627,5)								
Dividends		10	10	10	10	10	109,6	
Implied Cost of equity	**12,8%**							
g	2,67%							
Discount factor		0,887	0,786	0,697	0,618	0,548		
PV(Dividends)		8,9	7,9	7,0	6,2	5,5		
Sum of PV(Dividends)	35,3							
TV							1081,5	
PV(TV)	592,2							
Equity value	627,5							
Z Co.: DDM (market cap = 627,5 x (1 - 15%) = 533,4								
Dividends		10	10	10	10	10	109,6	
Implied Cost of equity	**14,0%**							
g	2,67%							
Discount factor		0,877	0,769	0,674	0,591	0,518		
PV(Dividends)		8,8	7,7	6,7	5,9	5,2		
Sum of PV(Dividends)	34,3							
TV							963,0	
PV(TV)	499,1							
Equity value	533,4							

This means that to calculate the implied cost of capital it is appropriate to:

a) consider an average market price, instead of an actual price;

b) calculate the average price over a time horizon consistent with that used to build the analysts' consensus (for example, if the consensus is built on the basis of the forecasts of the last 45 days, the market price should be the average for the last 45 days).

In the case of implied WACC (or implied unlevered cost of capital), the elasticity of the internal rate of return to changes in share prices (duration) is mitigated by the fact that the Enterprise Value (EV) is obtained by adding market capitalization (which changes as the share price fluctuates) to the book value of debt (which does not change) and, as such, it is affected to a lower extent by changes in market capitalization (the greater the debt the lower the extent[11]).

The use of either target prices or market prices

Sell side analysts forecast expected price changes of a share based on fundamental estimates. If the intrinsic value of a share is higher than its market price to an extent considered acceptable, the analyst issues a "buy" recommendation. By the same token, if the intrinsic value of a share is lower than its market price to an extent considered adequate, the analyst issues a "sell" recommendation. In all the other cases, analysts issue "hold" recommendations. Furthermore, equity reports indicate also a target price of the share, that is the price that a share might reach over a reasonable timeframe (generally 12 months), if the price should

[11] For highly indebted companies major changes in market capitalization entail changes in the market value of their debt. Thus, the assumption that the value of debt remains equal to its book value is a source of error in the estimation of implied cost of capital.

realign with intrinsic value. This is why equity reports indicate both the current share price (which varies by analyst as reports are drafted at different dates) and the target price (12-month forward).

In principle, if the share's current price were aligned with its intrinsic (or fundamental) value, the target price (which reflects a forward equilibrium price) could be derived from the following equation:

Target price = Current price × (1+ coe) – Dividends.

Accordingly, price and target price should return the same implied cost of capital.

On the other hand, when the share's current price is lower than its intrinsic (fundamental) value, the relationship is as follows:

Target price = Intrinsic value × (1 + coe) – Dividends

where:

if "Intrinsic value > Current price", the share is undervalued and, consequently, "Target Price > Current price × (1 + coe) – Dividends"; while

if "Intrinsic value < Current price" the share is overvalued and, consequently "Target Price < Current price × (1 + coe) – Dividends".

Table 8 also focuses on company Y, whose market capitalization is equal to € 627.5 million. Assuming that the common shares issued by the company are 100 million, the current price per share is € 6.27 (= 627.5/100). The cost of equity implied in the current price is 12.8% (as calculated in table 4). Table 8 shows two different cases where the share is considered, alternatively, overvalued or undervalued. Starting from the respective target prices, equal to € 5.1 per share (< 6.27 × (1 + coe) – Dividends) and € 11.0 per share (> 6.27 × (1 + coe) – Dividends), respectively, the relevant cost of equity is higher (16%) and lower (9%) than the cost of equity implied in the share's current price.

Table 8: Y Co: Price and target price (implied cost of capital)

years		1	2	3	4	5	TV	g
Y Co.: DDM (market cap = 627,5)								
Dividends		30,8	53,5	58,8	64,8	78,3	80,4	
Implied Cost of equity	12,80%							
g	2,67%							
Discount factor		0,887	0,786	0,697	0,618	0,548		
PV(Dividends)		27,3	42,0	41,0	40,0	42,9		
Sum of PV(Dividends)	193,2							
TV							793,1	
PV(TV)	434,3							
Equity value	627,5							
# shares	100,0							
Price per share	6,3							
Y Co. overvalued Target Price 12 months = 5,1								
Dividends		30,8	53,5	58,8	64,8	78,3	80,4	
Cost of equity implied in Target price	**16,0%**							
g	2,67%							
Discount factor		0,862	0,743	0,641	0,552	0,476		
PV(Dividends)		26,6	39,8	37,7	35,8	37,3		
Sum of PV(Dividends)	177,0							
TV							602,9	
PV(TV)	287,0							
Equity value (intrinsic value)	464,1							
# shares	100,0							
Intrinsic value per share	4,6							
Target price (12 months) = intrinsic value per share x (1+coe)+Dividends	**5,1**							
Y Co. undervalued Target Price 12 months = 11,0								
Dividends		30,8	53,5	58,8	64,8	78,3	80,4	
Cost of equity implied in Target Price	**9,0%**							
g	2,67%							
Discount factor		0,917	0,842	0,772	0,708	0,650		
PV(Dividends)		28,3	45,0	45,4	45,9	50,9		
Sum of PV(Dividends)	215,5							
TV							1269,5	
PV(TV)	825,1							
Equity value (intrinsic value)	1040,6							
# shares	100,0							
Intrinsic value per share	10,4							
Target price (12 months) = intrinsic value per share x (1+coe)+Dividends	**11,0**							

The difference between the cost of capital implied in the current price and the cost of capital implied in the consensus target price can, depending on the specific facts and circumstances, be due to one of the following:

a) returns required by investors (buy side) different from those used by analysts (sell side) in their estimates;

b) forecasts of profits and/or growth rate in terminal value by equity analysts different from those of investors (buy side);

c) the presence of premiums over and/or discounts to the share's intrinsic value based on the prevailing market sentiment (determined by non-fundamental reasons).

The asymmetry of analysts' forecasts

Empirical evidence point to excessively bullish analysts' (sell side) forecasts[12]. This might be due to many different reasons. The main reason however is that analysts' forecasts might be based on expected results associated with the most likely scenario (which do not necessarily reflects expected average streams of results). Certain brokerage houses (e.g. Morgan Stanley) require analysts to provide, in addition to the target price of the base scenario (built on the most likely scenario), also price forecasts related to two alternative scenarios (bull and bear). Bull and bear prices are constructed by considering risk factors that are not necessarily characterized by a normal distribution, such as: success or failure in the launch of a new product; new regulations; technological disruptions; growing competition etc. Bull and bear prices are built on conditional forecasts, that is forecasts assuming the materialization of certain events. The most likely scenario (used for the target price) typically corresponds to the average expected scenario (expected value forecast). Joos, Piotroski and Srinivasan show that the target price of Morgan Stanley's analysts (which is based on the base scenario) features (moderate) optimism, settling typically above the average between the bull price and the bear price.

If analysts' scenarios suffer from optimism bias, and the market is fundamentally efficient, the implied cost of capital calculated by reference to the current market price is systematically distorted upwardly, as the market price does not reflect the analysts' results[13] but the average expected results (which are not observable yet). The distortion of the implied cost of capital does not necessarily reduce its signalling capabilities. In fact, the implied cost of capital ends up capturing both the return required by the market and the premium for the specific risk (alpha) that the market implicitly applies to analysts' forecasts to translate them into market prices.

As there is evidence in the literature that optimism in consensus forecasts is more pronounced in the case of smaller companies and with more limited analyst coverage, it might be presumed that the smaller the size of the listed company concerned the greater the difference between implied cost of capital and cost of capital calculated on the basis of the CAPM or other models (also considering the size effect[14]). The difference between the two can be taken as the current measure of the alpha coefficient.

C) *The growth rate beyond the explicit forecast period*

So far analysts' consensus forecasts of the growth rate beyond the explicit forecast period have been assumed to be available. Typically this rate is indicated in the reports of equity analysts who estimate the intrinsic value of shares on the basis of expected results[15] but is not available in the traditional databases used by valuers. When the number of comparable companies is high, the manual search of the growth rate going through the single reports on each company can be complex or otherwise impracticable in terms of time and cost. However, the growth rate in terminal value is a very significant variable in the estimation of the implied cost of capital.

Table 9 shows the effects of a different growth rate in the estimation of terminal value on company Y's implied cost of capital (see table 6). A one percentage point decrease (from 2.67% to 1.67%) or increase (from 2.67% to 3.67%) in the growth rate determines a 60 bps. change in the implied cost of capital in the same direction.

Thus, the higher the growth rate used in the estimation of terminal value the greater the implied cost of capital and vice versa. Hence, the need to draw attention to two significant aspects:

a) the growth rate is a function of the valuation model adopted;

b) the growth rate is a function of the explicit forecast horizon.

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[12] "*Brown (1997) provides evidence that analysts' forecast errors are smaller for (1) S&P 500 firms;(2) firms with large market capitalization, large absolute value of earnings forecasts, and large analyst following; and (3) firms in certain industries*" in Peter Easton, Estimating the cost of capital implied by market prices and accounting data, *Foundation and trends in accounting* Vol. 2, No. 4, 2007 pp. 241-364 (2009).

[13] Easton e Sommers (2007) show that excessive optimism in analysts' forecasts translates into an average increase of 2.84% of the implied cost of capital for the market portfolio, a significant value considering the daily ERP generally measured through the implied cost of capital at the level of securities portfolios. Easton P. and Sommers, Effects of analysts' optimism on estimates of the expected rate of return implied by earnings forecasts" *Journal of Accounting Research*, 45 (December 2007) pp. 983-1015.

[14] The Fama French models considers specifically the size factor, while with respect to the CAPM the size factor is captured implicitly through the use of sum betas.

[15] It should be noted that:

a) not every analysts use valuation models founded on the discount to present value of expected streams of results, as many analysts only use multiples;

b) not all analysts report the input data used in their valuation.

Table 9: Y Co: implied cost of capital and g rate

years		1	2	3	4	5	TV	g
Y Co.: DDM (g = 2,67%)								
Dividends		30,8	53,5	58,8	64,8	78,3	80,4	
Implied Cost of equity	**12,8%**							
g	2,67%							
Discount factor		0,887	0,786	0,697	0,618	0,548		
PV(Dividends)		27,3	42,0	41,0	40,0	42,9		
Sum of PV(Dividends)	193,2							
TV							793,1	
PV(TV)	434,3							
Equity value	627,5							
Y Co.: DDM (g = 1,67%)								
Dividends		30,8	53,5	58,8	64,8	78,3	80,4	
Implied Cost of equity	**12,2%**							
g	1,67%							
Discount factor		0,891	0,795	0,709	0,632	0,563		
PV(Dividends)		27,5	42,5	41,7	40,9	44,1		
Sum of PV(Dividends)	196,7							
TV							765,2	
PV(TV)	430,8							
Equity value	627,5							
Y Co.: DDM (g = 3,67%)								
Dividends		30,8	53,5	58,8	64,8	78,3	80,4	
Implied Cost of equity	**13,4%**							
g	3,67%							
Discount factor		0,882	0,777	0,685	0,604	0,532		
PV(Dividends)		27,2	41,6	40,3	39,1	41,7		
Sum of PV(Dividends)	189,8							
TV							822,3	
PV(TV)	437,7							
Equity value	627,5							

The growth rate and the valuation model adopted

The relationship between growth rate and the valuation model adopted can be easily seen by way of example (table 10). Consider the case of a company in steady state[16] whose valuation does not require an explicit forecast period, as the equity value can be obtained by simply capitalizing in perpetuity the stream of income expected for the first year after the valuation date. The example is developed by considering four different growth rates of net income (ranging from 0% to 3%) and three different valuation methods (straight income-based, DDM and RIM).

Table 10: Growth rate and valuation method

	$g_{earnings}$ = 0% (stready state)	$g_{earnings}$ = 1%	$g_{earnings}$ = 2%	$g_{earnings}$ = 3%
Earnings	10	10	10	10
coc	8%	8%	8%	8%
$g_{earnings}$	0%	1,0%	2%	3%
Equity Value	125 = Earnings/coc	142,9 = Earnings/(coc -g)	166,7 = Earnings/(coc -g)	200,0 = Earnings/(coc -g)
Dividends	6	6	6	6
$g_{dvidends}$	3,2% = b x coc	3,8% = b x coc + $g_{earnings}$ x payout ratio	4,4% = b x coc + $g_{earnings}$ x payout ratio	5,0% = b x coc + $g_{earnings}$ x payout ratio
Equity Value	125 =Dividends/(coc-$g_{dividends}$)	142,9	166,7	200,0
Book Value (BV)	100	100	100	100
Residual Income (RI)	2 = Earnings - BV x coc	2	2	2
$g_{residual\ income}$	0%	3,3% = $g_{earnings}$/[PV(RI)/ Equity Value]	5,0% = $g_{earnings}$/[PV(RI)/Equity Value]	6,0% = $g_{earnings}$/[PV(RI)/Equity Value]
PV(RI)	25 = RI/coc	42,9	66,7	100,0
Equity Value	125 = BV + PV(RI)	142,9	166,7	200,0

The first column illustrates the case of no growth (g = 0)[17]. When there is no growth the income approach derives the equity value by calculating the ratio of net income to cost of capital. In our case, assuming a cost

[16] A company in steady state is a company that has exhausted all investment opportunities with returns higher than the cost of capital.

[17] A company in steady state is a company that has carried out all its investments at a positive NPV and that, as such, can reinvest any retained earnings at a rate of return not higher than cost of capital. The reinvestment of earnings does not generate wealth and, consequently, value.

of capital of 8% and net income of 10, the equity value is 125 (= 10/8%). When use is made of the DDM, and the pay-out is assumed to be lower than 100%, the equity value is obtained by capitalizing the dividend at a rate equal to the difference between the cost of capital and the dividend growth rate (equal to the product of the retention ratio – b – by the return on equity, which in the case of a company in steady state is equal to the cost of capital). Assuming a pay-out ratio of 60% (which reflects a retention rate b = 1 – pay-out ratio = 40%), given the cost of capital of 8%, the dividend growth rate is equal to 3.2% (= 40% × 8%) and the equity value is obtained by capitalizing expected dividends (= 10 × 60% = 6) at the difference between the cost of capital and the expected dividend growth rate [= 6/ (8% – 3.2%) = 125].

Thus, while the straight income approach requires the application of a zero growth rate, to return the same result the DDM requires a growth rate of 3.2% per year. Lastly, the example considers the RIM, which computes equity value by adding the book value of equity (equal to 100 in the example) to the present value of expected residual income (in the example equal to 2 = 10-8% × 100). In the case of the company in steady state, where reinvested earnings provide a return equal to the cost of capital, residual income cannot grow, thus also the growth rate of residual income to be utilized in the RIM is equal to zero. In fact, the equity value on the basis of the RIM is 100 + 2/8% = 125.

When a case different from a company in steady state is considered, and a growth rate for earnings is introduced, also the RIM requires growth rates different from the earnings growth rate, to obtain the same equity value. For example, if the earnings growth rate is equal to 1% and the equity value obtained on the basis of the income approach is equal to 142.9 [= 10/ (8% – 1%), second column of table 8]:

a) the growth rate that returns the same equity value is equal to 3.8% (obtained by adding the steady-state growth rate – equal to 3.2% = b × ROE = b × Coe = 40% × 8% = 3.2% – to the product of the earnings growth rate by the pay-out ratio – equal to 1% × 60% = 0,6% = pay-out ratio × $g_{earnings}$ –, thus 3.2% + 1% × 0.6 = 3.8%);

b) the residual income growth rate that returns the same equity value is equal to 3.3% [and reflects the earnings growth rate divided by the ratio of the present value of the residual income to the equity value = 1%/ (42.9/142.9) = 1%/30% = 3.3%].

The table illustrates also that for any earnings growth rate other than zero, the three growth rates – earnings, dividend and residual income – differ from one another. This means that:

a) the choice of the valuation model is not neutral in relation to the choice of the long-term growth rate;

b) when implied cost is calculated it is necessary, alternatively, to:

b1) utilize different growth rates, depending on the model or vice versa;

b2) adjust the stream of results (dividend or residual income) to be projected in perpetuity, which is not equal to the stream of the last year of explicit forecast multiplied by (1 + g), as illustrated in table 3.

Lastly, it should be remembered that the growth rate is a function also of the valuation perspective adopted (enterprise value or equity value). Tables 5, 6 and 7 have already shown that in the absence of constant leverage, the growth rate of net income (2.67%) – adopted to estimate the equity value – is greater than the growth rate of operating income and invested capital (2%), adopted to estimate the enterprise value.

Table 11 shows that in the presence of a variable leverage ratio, the growth rate of operating income (EBIT) and net income (NI) are necessarily different. Specifically, if the absolute value of debt is constant (and, accordingly, interest expense is constant) the growth rate of net income is always higher than the growth rate of EBIT.

Table 11: Growth rate Ebit and NI: Unvaried Debt vs. Constant Leverage

	Unvaried Debt			Constant Leverage		
	t=0	t= 1	g	t=0	t= 1	g
Ebit	100	102	2,0%	100	102	2,0%
Interest expenses	20	20	0,0%	20	20,4	2,0%
Ebt	80	82	2,5%	80	81,6	2,0%
Taxes @ 30%	24	24,6	2,5%	24	24,48	2,0%
NI	56	57,4	2,5%	56	57,12	2,0%

The growth rate and the explicit forecast horizon

When a sufficiently long explicit forecast horizon is adopted, the growth rate used to estimate terminal value should only reflect the industry's or the economy's long-term expectations and should not differ substantially among comparable companies[18]. This means that, to estimate the implied cost of capital, valuers could use the same long-term growth rate that they consider appropriate for the specific company to be valued. Actually, also in the literature the implied cost of capital is estimated by using proxies of industry or GDP growth rates or just long-term inflation rates[19].

However, in practical terms, it should be noted that equity analysts' forecasts:

a) never go beyond a five-year horizon;

b) can be relied on typically only for the first three years (as just few analysts make forecasts for the fourth and fifth year).

The consequence is that, for all fast-growing companies for which the excess earnings growth[20] is expected to continue beyond the analysts' forecast horizon, application of the consensus growth rate to the earnings of the last year of the forecast would result in an underestimated implied cost of capital, with the paradox that the greater the excess earnings growth beyond the explicit forecast period the lower the implied cost of capital and, consequently, the greater the risk associated with this growth. This is why, in companies with particularly high growth prospects, it is necessary to adopt multi-stage growth models. To that end, it is necessary to identify growth rates to be applied to the streams of results generated after the analysts' forecast horizon whose intensity and duration reflect directly on the cost of equity. More often, the excess earnings growth rate is estimated on the basis of the progressive convergence of the return on equity of the specific company towards the average ROE for the industry. The constant erosion of abnormal returns over time and the convergence toward normal industry returns are the two most common assumptions underlying the estimation of the excess earnings growth rate.

It is important to point out that any earnings and cash-flow growth forecasts need to be consistent with the investments necessary to support the growth of results. The typical decline of growth rates goes hand in hand also with rising investments to support growth, owing to the natural decrease of the marginal efficiency of capital. As a reminder, given that the growth rate g is equal to the product of the retention rate (b) by the return on equity, if g falls while b rises, the return on equity can only decrease faster than g.

In other words, beyond a given point in the future, high though as the growth rate g might still be, growth should not affect the enterprise value (and the implied cost of capital), as the reinvestment of earnings should be such as to realign the return on investment with the cost of equity.

Table 12A illustrates the case of listed company W, which has a P/E_1 of 35x. Such a high multiple is indicative of very high earnings growth prospects. The analysts' consensus projects a 40% earnings growth rate for year 2 and a 38% earnings growth rate for year 3, with a pay-out ratio of 80%. The valuation model used is the DDM. Assuming a 2% GDP growth rate to calculate W's terminal value and limiting the analysis to the first three years, the implied cost of capital would be 7%. The table shows two other valuations founded both on the explicit forecast period and on successive fading periods (each of 6 and 9 years) where the excess earnings growth rates converge progressively toward the GDP growth rate. In the fading growth period, the pay-out is equal to that of the consensus for the first three years (80%). The table shows how the implied cost of capital increases as the fading growth period extends. In particular, by adopting a fading period of 6 years the implied cost of capital is 10.7% while for a fading period of 9 years the implied cost of capital rises to 13%.

[18] The earnings growth rate beyond the explicit forecast horizon can be calculated, for example, on the basis of a medium/long-term average retention rate and the average ROE for the industry.

[19] For a review of the literature, see Easton P., 'Estimating the cost of capital implied by market prices and accounting data', *Foundations and Trends in Accounting*, Vol. 2, No. 4, 2007, p. 282.

[20] Excess earnings growth refers to a growth rate for the specific company that exceeds that of the industry in which it operates or the economy.

Table 12 A: Implied cost of capital and extra-growth (same payout ratio in fading period)

No Fading period		**Consensus Forecasts**			
years		**1**	**2**	**3**	TV
NI		100	140	193	196,9
g			40%	38%	
Payout ratio	80,00%				
Dividends		80,0	112,0	154,4	157,5
Implied cost of capital	**7,0%**				
$g_{Terminal\ value}$	2%				
Discount factor		0,934	0,873	0,816	
PV(Dividends)		74,8	97,8	126,0	
Sum of PV(Dividends)	298,5				
TV					3923,8
PV(TV)	3201,5				
Equity value	3500,0				

Fading period 6 years		**Consensus Forecasts**			**Fading growth rate (6 years)**						TV
years		**1**	**2**	**3**	4	5	6	7	8	9	
NI		100	140	193	254,8	321,0	385,2	439,1	474,3	483,7	493,4
g			40%	38%	32%	26%	20%	14%	8%	2%	
Payout ratio (consensus analysts)	80,00%										
Payout ratio (fading period)	80,00%										
Dividends		80,0	112,0	154,4	203,8	256,8	308,2	351,3	379,4	387,0	
Implied cost of capital	**10,7%**										
$g_{Terminal\ value}$	2%										
Discount factor		0,903	0,816	0,737	0,666	0,601	0,543	0,491	0,443	0,400	
PV(Dividends)		72,3	91,4	113,8	135,7	154,4	167,4	172,4	168,2	155,0	
Sum of PV(Dividends)	1230,5										
TV											5668,1
PV(TV)	2269,5										
Equity value	3500,0										

Fading period 9 years		**Consensus Forecasts**			**Fading growth rate (9 years)**									TV
years		**1**	**2**	**3**	4	5	6	7	8	9	10	11	12	
NI		100	140	193	258,6	336,2	423,6	516,8	609,8	695,2	764,7	810,6	826,8	
g			40%	38%	34%	30%	26%	22%	18%	14%	10%	6%	2%	
Payout ratio (consensus analysts)	80,00%													
Payot ratio (fading period)	80,00%													
Dividends		80,0	112,0	154,4	206,9	269,0	338,9	413,5	487,9	556,2	611,8	648,5	661,5	
Implied cost of capital	**13,0%**													
$g_{Terminal\ value}$	2%													
Discount factor		0,885	0,783	0,692	0,613	0,542	0,479	0,424	0,375	0,332	0,294	0,260	0,230	
PV(Dividends)		70,8	87,7	106,9	126,7	145,8	162,5	175,4	183,1	184,6	179,7	168,5	152,0	
Sum of PV(Dividends)	1743,5													
TV														7642
PV(TV)	1756,5													
Equity value	**3500,0**													

Table 12B also describes the case of listed company W, with the same fading periods to calculate the implied cost of capital. The only difference from table 12A is that the pay-out ratio in the fading period is 40%, instead of 80%, on the assumption that the excess earnings growth after the explicit forecast period requires more investments and that the return on equity will fall. The introduction of this assumption reduces the implied cost of capital compared to those calculated in table 12A. In particular, in the case of a fading period of 6 years the implied coe declines from 10.7% to 9.8% while in the case of the fading period of 9 years it falls from 13% to 11.5%.

Table 12 B: Implied cost of capital and extra-growth (lower payout ratio in fading period)

No Fading period		Consensus Forecasts			
years		1	2	3	TV
NI		100	140	193	196,9
g			40%	38%	
Payout ratio	80,00%				
Dividends		80,0	112,0	154,4	157,5
Implied cost of capital	**7,0%**				
$g_{Terminal\ value}$	2%				
Discount factor		0,934	0,873	0,816	
PV(Dividends)		74,8	97,8	126,0	
Sum of PV(Dividends)	298,5				
TV					3923,8
PV(TV)	3201,5				
Equity value	3500,0				

Fading period 6 years		Consensus Forecasts			Fading growth rate (6 years)						TV
years		1	2	3	4	5	6	7	8	9	
NI		100	140	193	254,8	321,0	385,2	439,1	474,3	483,7	493,4
g			40%	38%	32%	26%	20%	14%	8%	2%	
Payout ratio (consensus analysts)	80,00%										
Payout ratio (fading period)	40,00%										
Dividends		80,0	112,0	154,4	101,9	128,4	154,1	175,6	189,7	193,5	
Implied cost of capital	**9,8%**										
$g_{Terminal\ value}$	2%										
Discount factor		0,911	0,829	0,755	0,687	0,626	0,570	0,519	0,473	0,430	
PV(Dividends)		72,8	92,9	116,6	70,1	80,4	87,8	91,2	89,7	83,3	
Sum of PV(Dividends)	784,7										
TV											6309,2
PV(TV)	2715,3										
Equity value	3500,0										

Fading period 9 years		Consensus Forecasts			Fading growth rate (9 years)									TV
years		1	2	3	4	5	6	7	8	9	10	11	12	TV
NI		100	140	193	258,6	336,2	423,6	516,8	609,8	695,2	764,7	810,6	826,8	
g			40%	38%	34%	30%	26%	22%	18%	14%	10%	6%	2%	
Payout ratio (consensus analysts)	80,00%													
Payot ratio (fading period)	40,00%													
Dividends		80,0	112,0	154,4	103,4	134,5	169,4	206,7	243,9	278,1	305,9	324,3	330,7	
Implied cost of capital	**11,5%**													
$g_{Terminal\ value}$	2%													
Discount factor		0,897	0,804	0,721	0,647	0,580	0,520	0,467	0,418	0,375	0,336	0,302	0,271	
PV(Dividends)		71,7	90,1	111,4	66,9	78,0	88,1	96,4	102,1	104,3	102,9	97,8	89,5	
Sum of PV(Dividends)	1099,4													
TV														8871
PV(TV)	2400,6													
Equity value	**3500,0**													
Sinthetic Calculation of implied cost of capital: Easton's Formulas														
PEG ratio														
Implied cost of capital PEG/Easton	**10,7%**	=((Nit+1 -Nit)/P)^0,5 '= (1/PEG*100)^0,5 = (35/40)^0,5												
AEG = Ni_{t+1}+Div_t x coc -Ni_t x (1+coc)			**37,9**	50,0	61,5	61,0	65,8	66,0	59,9	46,3	24,9	-3,2	-35,8	
average AEG_{2-12}			39,5											
Delta% average AEG_{2-12} vs. AEG_2			4,3%											
Modified PEG ratio														
implied cost of capital Modified PEG/Easton	**12,0%**													
Div_1/P	2,3%													
(N_2 - NI_1)/P	1,1%													
coc^2-coc*Div_1/P - (Ni_2-NI_1)/P = 0	0,00													

A short method to calculate the implied cost of capital for growth companies was developed by Eaton. The benefit of this method is the lack of need to make assumptions regarding the excess earnings growth rate after the explicit forecast period. The method is derived from the AEG model and is based on the assumption of a constant Abnormal Earning Growth (g_{AEG} = 0).

The formula to calculate the implied cost of capital (implied coc) is as follows (i.e. Modified PEG ratio[21]):

$$\text{implied coc}^2 - \text{implied coc} \times Div_1/P_0 - (NI_2 - NI_1)/P_0 = 0$$

When it is assumed that there is no dividend in the first year of explicit forecast, the formula is further simplified and the implied cost of capital is the square root of the inverse of the PEG ratio (i.e. PEG ratio formula), that is:

implied coc = [1/(PEG*100)]^0,5

Table 12B shows the calculation of the implied cost of capital on the basis of Easton's two formulas. Even though the condition of constant AEG is not met, in the case of the 9-year fading period the average AEG is very close to the first year's AEG. Thus, by applying Easton's two formulas (PEG ratio and Modified PEG

[21] The PEG ratio is the P/E multiple divided by the expected earnings growth rate multiplied by 100. In Easton's version, the PEG ratio considers the earnings growth between years 1 and 2. Regarding the example of table 10 (company W), the analysts' consensus calls for a 40% net income growth rate between years 1 and 2 (from 100 to 140). As the company's P/E is equal to 35 the PEG is 35/40 = 0.875.

ratio) the result should be an implied cost of capital very close to that calculated analytically over a 9-year fading period. In fact, the table shows that the PEG formula returns an implied cost of capital of 10.7% while the Modified PEG formula an implied cost of capital of 12%, vis-à-vis an implied cost of capital calculated analytically of 11.5%.

4. Two practical applications of the implied cost of capital

This section intends to show two different applications of the implied cost of capital to two listed companies. Both companies are listed on the Italian stock exchange.

One is a multinational company (Pirelli) while the second is a medium-size company engaged in the luxury goods industry (Tod's). In Pirelli's case the implied cost of capital is used to clarify the uncertainty related to the CAPM factors to be used to estimate the cost of equity (considering that it is a company listed in Italy but operating on a global scale). In Tod's case, the implied cost of capital is utilized instead to compare the reasonableness of the estimate that would be obtained by using the multiples of comparable companies.

The implied cost of capital for a multinational company

Pirelli is a multinational group with operations in thirteen countries. In 2017, Europe accounted for only 41.7% of Group revenue. Pirelli is listed on the Italian stock exchange, after it went public on 4 October 2017 (IPO date). Between the IPO and January 2018, 10 equity analyst reports have been published (table 13) which indicate the cost of capital (WACC) used by the analysts to make their estimates (of these, seven reports indicted also the growth rates of operating income to estimate terminal value). The median WACC is 8% while the median growth rate g is 2.5%; however, the parameters vary widely among the individual analysts, with the WACC ranging from 6.3% and 10% and g ranging from 1% and 3.5%. There is no clear-cut relationship between WACC and g. For example, Beremberg estimates the WACC at 8.5% and the growth rate g at 3%, while Kepler Chevreux estimates the WACC at 10% and the growth rate g at 2.5%.

Table 13: Pirelli Group: Consensus Estimates of WACC and g

Broker	Report date	WACC	g	WACC - g
Morgan Stanley	26/01/2018	7,80%	1,50%	6,30%
Exane	24/01/2018	8,30%	n.a.	n.a.
UBS	23/01/2018	9,00%	3,50%	5,50%
Equita	19/12/2017	7,89%	2,00%	5,89%
Goldman Sachs	07/12/2017	8,00%	n.a.	n.a.
HSBC	10/11/2017	8,00%	2,50%	5,50%
Kepler Cheuvreux	09/11/2017	10,00%	2,50%	7,50%
Banca IMI	09/11/2017	7,30%	1,00%	6,30%
Mediobanca	09/11/2017	6,30%	n.a.	n.a.
Beremberg	06/10/2017	8,50%	3,00%	5,50%
	Mean	8,11%	2,29%	6,07%
	Median	**8,00%**	**2,50%**	**5,89%**
	Max	10,00%	3,50%	7,50%
	Min	6,30%	1,00%	5,50%
	# Obs	10	7	7

Table 14 shows six different variations for the calculation of Pirelli's WACC at 31 December 2017, on the basis of the CAPM and the MM formula. These variations assume different:

i. risk-free rates (1-, 3- or 5-year average using the 10-year IRS or the Italian government bond);

ii. ERPs (implicit in the Stoxx 600 or derived from surveys of Italy);

iii. Betas (calculated in relation to the MSCI-World index or the Italian index).

A range of estimates varying between 5.9% and 9% is obtained (a range very close to that of the analysts and equally broad).

Table 14: Pirelli Group: Cost of Equity (CAPM) and WACC $_{(MM)}$ calculation as of 31.12.2017

	Beta vs. MSCI World - Implied ERP Stoxx 600 - Mean 1Y - Rf Mean 1Y IRS	Beta vs. MSCI World - ERP Mean 3Y Stoxx 600 - Rf Mean 3Y IRS	Beta vs. MSCI World - ERP Mean 5Y Stoxx 600 - Rf Mean 5Y IRS	Beta vs. Local Index - Historical ERP Italy - Rf Italy Mean 1Y	Beta vs. Local Index - Historical ERP Italy - Rf Italy Mean 3Y	Beta vs. Local Index - Historical ERP Italy - Rf Italy Mean 5Y
Beta Relevered Adj.	1,24x	1,24x	1,24x	1,12x	1,12x	1,12x
Equity Risk Premium	4,46%	4,84%	4,81%	6,50%	6,50%	6,50%
Risk-free rate	0,82%	0,74%	1,12%	2,07%	1,73%	2,47%
Cost of Equity	**6,37%**	**6,76%**	**7,10%**	**9,37%**	**9,03%**	**9,76%**
Risk-free rate	0,82%	0,74%	1,12%	2,07%	1,73%	2,47%
Credit spread (CDS 10Y - Media 1Y)	1,99%	1,99%	1,99%	1,99%	1,99%	1,99%
Cost of Debt$_{(pre-tax)}$	**2,81%**	**2,73%**	**3,11%**	**4,06%**	**3,72%**	**4,45%**
Tc	34,00%	34,00%	34,00%	34,00%	34,00%	34,00%
Cost of Debt$_{(post-tax)}$	**1,85%**	**1,80%**	**2,05%**	**2,68%**	**2,46%**	**2,94%**
D/EV target	10,14%	10,14%	10,14%	10,14%	10,14%	10,14%
E/EV target	89,86%	89,86%	89,86%	89,86%	89,86%	89,86%
WACC$_{(post-tax)}$	**5,91%**	**6,26%**	**6,59%**	**8,69%**	**8,36%**	**9,07%**

On the basis of the analysts' consensus forecasts for the three-year period 2018-2020 and the Enterprise Value (average between the IPO date and January 2018), table 15 derives the implied WACC on the basis of the RIM (enterprise value) and the median consensus growth rate g. The implied WACC is 8.36%, which is slightly higher than the analysts' median WACC and slightly lower than the highest WACC estimated with the CAPM (= 9.06%). Table 16 derives the implied cost of equity on the basis of both the RIM (equity value) and the growth rate g (assuming a constant financial structure). The implied cost of equity is 9.22%, which is slightly lower than the highest estimate calculated with the CAPM (9.75%) by using the average risk-free rate for the last five years (interest rate on 10-year Italian government bond), the historical long-term ERP and the beta coefficient computed in relation to the local stock market. Thus, even though Pirelli is a multinational company, investors require returns based on local input factors (risk-free rate, ERP and beta).

Table 15: Pirelli: Implied WACC (RIM Asset-side)

	2017	2018	2019	2020	TV
NOPAT		**527**	**631**	**738**	**874**
+ D&A ex-Amortization from PPA		279	301	322	
+ Amortization from PPA		115	115	115	
- Capex		-433	-441	-434	
- ΔNWC		-294	-17	-19	
UFCF **		**194**	**588**	**721**	
Initial Invested Capital		**7.362**	**7.694**	**7.737**	**7.754**
+ Net Investment of the period		333	43	17	
Final Invested Capital	**7.362**	**7.694**	**7.737**	**7.754**	
NOPAT		527	631	738	874
WACC x Initial Invested Capital		-615	-643	-647	-648
Residual Income - Asset-side		**-89**	**-12**	**91**	**226**
Implied WACC	8,36%				
g - Consensus (Median) from IPO date to 26.01.2018	2,50%				
Years		1	2	3	
Discount Factor		0,923	0,852	0,786	
PV(Residual Income)		-81,8	-10,4	71,8	
SUM[PV(Residual Income)]	-20				
TV(Residual Income)					3.855
PV[TV(Residual Income)]	3.031				
Operating Invested Capital 2017	7.362				
Enterprise Value core	**10.372**				
+ Participations in Associates and JV	17				
+ Other Financial Assets	230				
+ Net Invested Capital held for Sale	61				
Total Enterprise Value	**10.680**				
- Net Financial Debt	-3.218				
- Employee Benefit Obligations	-274				
- Book Value Minorities	-60				
Market Capitalization Average 26.01.2018 - 04.10.2017 (IPO date)	**7.127**				

*** UFCF TV = NOPAT 2020 x (1 + g) x (1 - IR)*

Table 16: Pirelli: Implied Coe (RIM Equity-side)

	2017	2018	2019	2020	TV
Net Income from continuing operations		446,4	574,0	699,1	
Pay-out ratio		*0,0%*	*40,0%*	*40,0%*	
Dividend		0,0	229,6	279,7	
Initial Book Value to shareholders		**4.116,8**	**4.563,1**	**4.907,5**	**5.327,0**
+ Net Income		446,4	574,0	699,1	
- Dividend		0,0	-229,6	-279,7	
Final Book Value to shareholders	**4.116,8**	**4.563,1**	**4.907,5**	**5.327,0**	
Net Income		446,4	574,0	699,1	716,6
Coe x Initial Book Value		-379,7	-420,9	-452,7	-491,4
Residual Income - Equity-side		**66,6**	**153,1**	**246,5**	**225,2**
Implied Coe	9,22%				
g - Consensus (Median) from IPO date to 26.01.2018	2,50%				
Years		1	2	3	
Discount Factor		0,916	0,838	0,767	
PV(Residual Income)		61,0	128,3	189,1	
SUM[PV(Residual Income)]	378,4				
TV(Residual Income)					3.349,6
PV[TV(Residual Income)]	2.570,6				
Book Value 2017	4.116,8				
Net Invested Capital held for Sale	60,7				
Market Capitalization Average 26.01.2018 - 04.10.2017 (IPO date)	**7.127**				

The implied cost of capital and valuations using multiples

Tod's is a company engaged in luxury goods, a sector that encompasses a wide range of consumer products (to leather shoes and accessories and clothes). The listed companies that are traditionally classified in this sector (excluding Tod's) are 12. Table 17 shows the EV/Sales and EV/EBITDA multiples calculated on the basis of the EV at 31 December 2017 and the consensus expectations of sales and EBITDA for 2018. The table shows the presence of two outlier companies (Hermes and Brunello Cucinelli) whose multiples are much higher than those of all the other sector companies. Excluding the two outliers, the multiples of the remaining 10 companies do not show excessive dispersion. In particular, the EV/EBITDA multiple varies between 10x and 14x. The average multiple (harmonic mean) is 12.16x. By applying the multiple in question to the consensus forecast of Tod's 2018 EBITDA, the amount per share is slightly higher than the current price of the share at 31 December 2017 (€ 62.59 vs. € 60.90). However, this estimate is in contrast with the analysts' target price of € 56.31 per share (table 18).

Table 17: Multiple for Luxury Sector (Tod's excluded)

	Country	EV/Sales 2018	EV/EBITDA 2018
Burberry Group	UNITED KINGDOM	2,43x	10,92x
Richemont	SWITZERLAND	3,10x	12,41x
Kering	FRANCE	3,20x	14,20x
LVMH	FRANCE	2,94x	11,82x
Michael Kors	UNITED STATES	2,12x	10,06x
Moncler	ITALY	4,84x	14,45x
Prada	HONG KONG	2,51x	11,49x
Salvatore Ferragamo	ITALY	2,51x	13,75x
Swatch Group	SWITZERLAND	2,39x	11,86x
Tiffany & Co.	UNITED STATES	3,01x	12,15x
	Mean	**2,91x**	**12,31x**
	Armonic Mean	**2,77x**	**12,16x**
	Var. Coeff.	**0,26**	**0,12**

Outliers based on EV/EBITDA 2018

Hermes International	FRANCE	7,41x	20,05x
Brunello Cucinelli	ITALY	3,38x	19,35x

Source: FactSet as of 31.12.2017

Table 18: TOD'S 's Multiple Valuation as of 31.12.2017 - Data in mln of Euro

EV/EBITDA 2018 - Armonic Mean of the Industry	12,16x
EBITDA 2018 Consensus (Mean 75d)	170,7
EV core	**2.076,1**
+ Participation	0,02
EV Total	**2.076,1**
- (Net Cash)	9,3
- Employee Benefit Obligations	-13,2
- Book Value Minorities	-0,9
Equity Value	**2.071,4**
N° Shares	33,09
Equiy Value per share	**€ 62,59**
Price as of 31.12.2017	**€ 60,90**
% Up-side	***2,8%***
Group Book Value as of 31.12.2017	1.086,3
Equity Value / Book Value	**1,91x**
Target Price - Mean 75d as of 31.12.2017	**€ 56,31**
% Up-side	***11,2%***

Source: FactSet as of 31.12.2017

Table 19 shows the estimated WACC implied in the valuation based on the average multiple of the comparable companies (€ 62,59 per share) on the basis of the DCF (enterprise value), the analysts' consensus forecast for the 2018-2020 three-year period and a growth rate of the unlevered free cash flow (UFCF) beyond the explicit forecast period of 2.5% (analysts' consensus). The implied WACC is equal to 6.4%. This is too low, taking into account that in its 2017 annual report Tod's itself indicated that it had used a

WACC of 8.5% to test its goodwill for impairment (IAS 36). The excessively low implied WACC derives from a market value estimated using multiples that was not in line with analysts' expectations. In this case the implied cost of capital provides a glimpse into the reasonableness, or lack thereof, of the estimates derived from the multiples of companies considered comparable on the basis of the sector to which they belong, but not in terms of expected earnings growth and risk profile of results.

Table 19: TOD'S 's: Implied WACC (DCF Asset-side)

In mln of Euro	2017	2018	2019	2020	TV
NOPAT		**84,4**	**94,6**	**111,7**	**114,4**
+ D&A		50,1	50,2	53,0	
- Capex		-47,9	-45,5	-45,8	
- ΔNWC		-7,3	-10,5	-10,1	
UFCF **		**79,3**	**88,7**	**108,7**	**86,8**
Implied WACC *	6,43%				
g rate	2,50%				
Years		1	2	3	
Discount Factor		0,940	0,883	0,830	
PV(UFCF)		74,5	78,3	90,2	
SUM[PV(UFCF)]	243,0				
TV(UFCF)					2.209,9
PV[TV(UFCF)]	1.833,2				
Enterprise Value core	**2.076,1**				
+ Participations	0,02				
Total Enterprise Value	**2.076,1**				
- (Net Cash)	9,3				
- Employee Benefit Obligations	-13,2				
- Book Value Minorities	-0,9				
Equity Value	**2.071,4**				
N° Shares	33,1				
Implied Equity Value per share in Multiple Valuation as of 31.12.2017	**€ 62,59**				

** WACC Impairment Test 2017 = 8,50%*
*** UFCF TV = NOPAT 2020 x (1 + g) x (1 - IR)*

5. Conclusions

Use of the implied cost of capital is contemplated also by the International Valuation Standards 2017.

The article has illustrated methodologies to estimate the implied cost of capital of a specific company. The implied cost of capital can be used:

A) in the case of listed companies:

a) to guide the valuer in the estimation of the cost of capital on the basis of the CAPM and the MM formula;

b) to have a measure of the alpha coefficient that the market applies to the cost of capital estimated through the CAPM when the analysts' (sell side) consensus earnings forecasts are discounted to present value;

c) to test the reasonableness of estimates founded on the market approach;

B) in the case of non-listed companies:

a) to have, for the comparable companies from which the CAPM beta and the target financial structure are derived, the difference between the implied cost of capital and the cost of capital estimated by using the CAPM and the MM formula;

b) to have, for the comparable companies from which the multiples are derived, a test of reasonableness in the application of the multiples to the specific company to be valued.

The main limitation to the implied cost of capital is the need to have an earnings growth rate (g) applicable after the explicit forecast period. However, with the exception of companies with high growth rates, the long-term growth rate of all companies should converge toward that of the economy as a whole or the industry in which the company operates.

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