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Business Valuation OIV Journal has been created by OIV- Organismo Italiano di Valutazione – the Italian Valuation Standard Setter – to provide a forum for discussion and to foster cultural progress in the field of business valuation.

OIV is a non-profit Foundation established by the main Italian professional organizations and institutions engaged in valuation[1] and its activities include the advancement of a valuation culture, including through international debate. The Journal can be downloaded free of charge from the OIV (www.fondazioneoiv.it) and the IVSC-International Valuation Standard Council (www.ivsc.org) websites.

Business valuation should not be regarded as the mechanical application of valuation models but as a procedure adopted by an expert capable of using appropriate valuation models in a given context - in light of specific facts and circumstances – and for the stated purpose. Accordingly, valuation is not a routine-based exercise but a process rooted in subjective, professional judgment. To ensure that it does not turn into mere discretionality, subjectivity needs to be anchored to a solid framework of standards and best practices. As such, diligent attention to the development of standards and best practices is first and foremost an ethical duty, more than a professional obligation, of the business valuer.

While business valuation is global in scope, there is a very limited number of platforms where experts from different countries can debate advanced professional issues and the profession is still highly fragmented. Due to language and jurisdiction barriers, many manuals, documents and valuation practices remain confined to their countries of origin. Accordingly, it transpires that many good practices developed in a country may not be known abroad and their application outside that country is met with suspicion, even when common valuation standards are adopted. The different cultural references in terms of standards, concepts and methodologies engender extreme prudence in the adoption of foreign solutions and experiences, with the result that significant professional growth opportunities may be lost. *Business Valuation OIV Journal* wants to be a bridge among national communities of business valuers, with the objective of facilitating the exchange of experiences and competencies, overcoming national barriers in terms of false prejudice and preconceived notions regarding experiences developed in different contexts.

Obviously, geography in business valuation matters, as the characteristics of each country do affect the environment in which valuation experts are called upon to perform their estimations. As an example, one might consider the average size and the prevailing governance of companies; the degree of development of equity markets and private equity; the stability of macroeconomic and financial conditions; tax regulations and, lastly, a law that may require valuations for different purposes, assuming bases of value that may vary significantly from one another. These are aspects that affect the activities of valuation experts and the solutions that they develop. On the other hand, many of these aspects are common to different countries and occur in similar forms across many geographies. For example, most European countries have in common the limited relevance of financial and equity markets compared to banking as a source of finance; a preference for group structures instead of a divisional organizational structure; similar legal protection for minorities, etc. All these elements are reflected in such significant

[1] OIV's founding entities are AIAF- Associazione Italiana di Analisti Finanziari, ANDAF – Associazione Italiana dei Direttori Ammnistrativi e Finanziari, ASSIREVI- Associazione Italiana Revisori Contabili, Borsa Italiana, CNDCEC- Consiglio nazionale dei Dottori Commercialisti e degli Esperti Contabili, Università L. Bocconi.

assumptions by the business valuer as estimated cost of capital, estimated liquidity discount and control premium, estimated diversification and holding discounts, the valuation of cross-holdings, the impact of tax loss carryforwards, the measurement of transferable goodwill, to mention but a few. Other aspects that cut across geographies concern listed companies and the growing role of liquidity in explaining equity prices and their volatility as well as the progressively diminishing role of fundamental analysis and value investing.

Business Valuation OIV Journal intends to foster the extension of domestic experiences and solutions to advanced valuation problems common to different geographical areas and broader sectors by publishing high-quality, practitioner-relevant articles. The journal's objective is to stimulate the exchange of the best practice, practical solutions, evidence and, more generally, experiences developed in academia and international professional practice for the cultural and professional advancement of the Business Valuer community.

Valuing means measuring and measurement requires the exercise of three different capabilities: good thinking, good application and good balance between costs and benefits [2]. The articles that the Journal intends to publish concern all three capabilities. Thus, these articles will not only report empirical evidence but also comparative analyses, conceptual frameworks and innovative solutions, with the greatest variety of approaches and methods. Articles will be screened in relation to their ability to offer new elements to the reader community. With that in mind, articles might be intended, without limitation, to:

- fill the gap between theory and practice in business valuation;
- identify theoretically sound solutions to new valuation problems;
- propose solutions commonly accepted at the national level but unknown to the international community;
- produce meaningful evidence for business valuation purposes;
- encourage debate on significant issues at the international level;
- raise criticism to long-held professional consensus views;
- identify areas where a consensus view is missing;
- explore issues related to value measurement in contexts other than those assumed by business valuation theory;
- provide solutions to test the reasonableness of prospective information.

[2] Mention S. H. Penman, Financial statement analysis and security valuation McGraw Hill, 4th ed., page 21.

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

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[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.

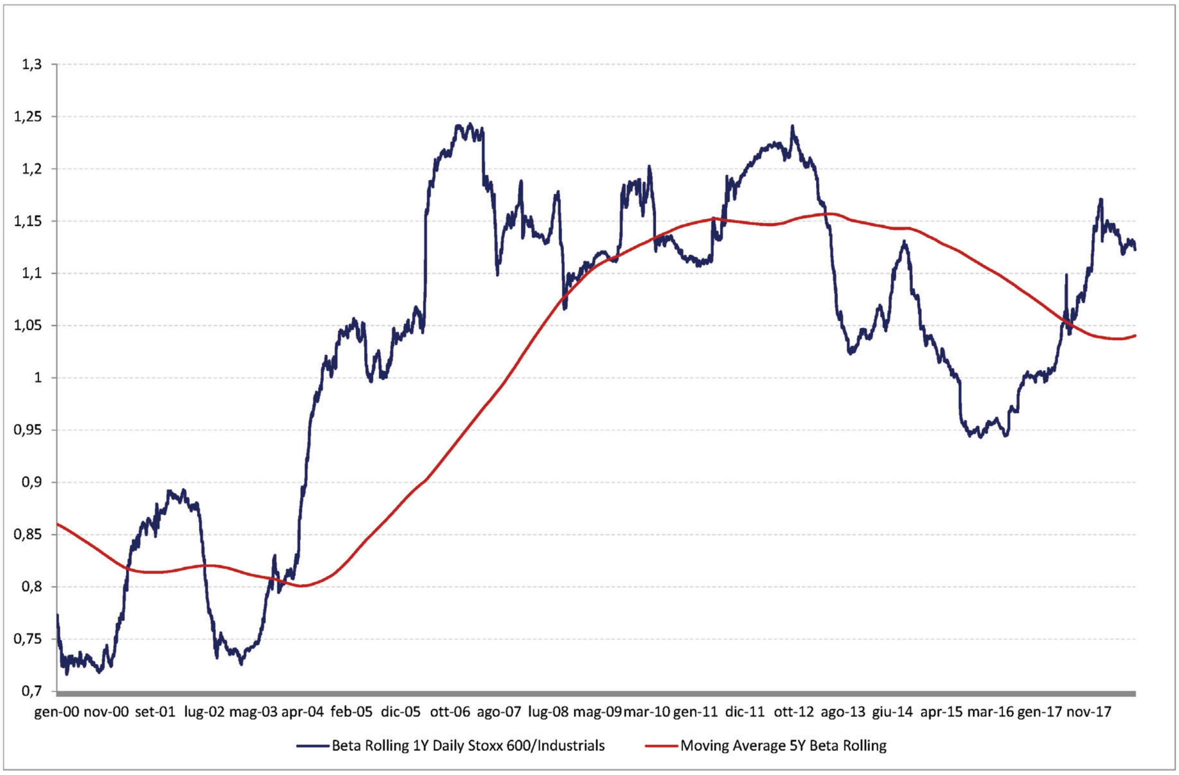
Table 2: Different options for estimating the expected return of the market and of aggressive stock and defensive stock

					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%

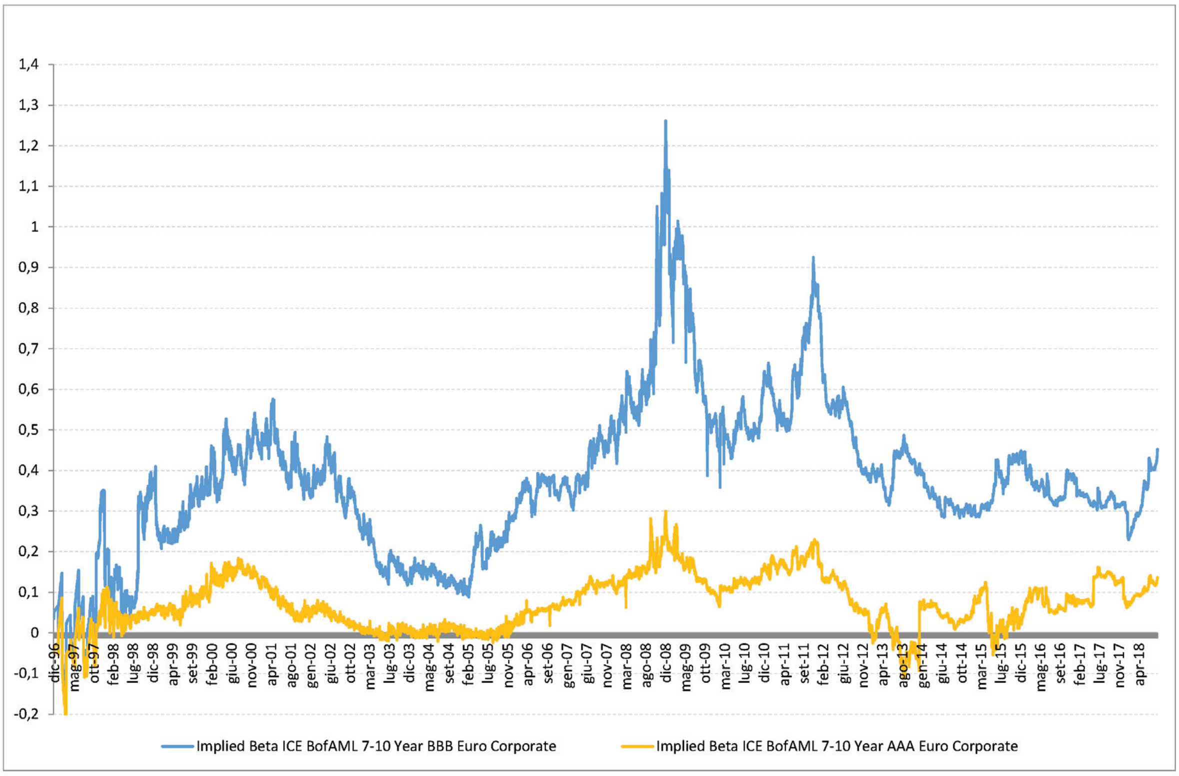
Further complications arise when the beta coefficients are estimated. Graph 1 illustrates changes in the beta coefficients of the shares of the companies included in the Stoxx 600 Industrials, as calculated on the basis of daily rolling returns over a one-year period and the 5-year moving average of 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:

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

where:

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

thus:

Residual Income $_{year\ 6}$ ≠ Residual Income $_{year\ 5}$ × (1 + g)

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

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

where:

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

thus:

Dividends $_{year\ 6}$ ≠ Dividends $_{year\ 5}$ × (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:

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

Dividends $_{year\ 6}$ = Dividends $_{year\ 5}$ × (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.

The valuation perspective (enterprise value or equity value)

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 $\times$ 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 $\times$ $(1 - T_c\, B/EV)$.

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)									
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)	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)**									
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]):

implied coc^2 – implied coc × 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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Solvency II Framework in Insurance Equity Valuation: Some Critical Issues

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A new regulatory framework – Solvency 2 – has been in place for over two years in the European insurance industry. Given that an increased number of market participants are availing of Solvency 2 data in assessing insurance equity valuations, this paper aims to highlight some critical issues and shortcomings associated with that practise.

1. Introduction

For all regulated European insurance entities a new solvency regime called Solvency 2 (S2 from now onwards) became effective since 1st January 2016. Under the new framework, insurance companies determine their level of available capital resources (EOF or Eligible Own Funds) and relate that to their stochastically calculated level of required capital (SCR or solvency capital required) thus deriving a certain Solvency Ratio (EOF over SCR). The aim of the regulator (EIOPA) was to move away from the old deterministic and not risk-based Solvency 1 regime towards a more market-consistent and risk-based approach to measure available capital.

During the course of the last two and a half years, an increasing number of equity market participants started to use S2 data in order to assess the equity fair value of listed insurance groups. Moving from the actual Solvency Ratio components (EOF/SCR), analysts and investors started to focus on price-to-equity capital ratios (namely unrestricted Tier 1) while the information on capital generation has been used to estimate free cash flows available to shareholders in order to calculate the equity fundamental value.

In this work, we would like to highlight some critical issues in using the S2 framework to build a coherent and informed valuation to compare to the current market price.

The study will proceed as follows: we start to briefly summarise the main drivers of the S2 framework, showing the elements constituting the SCR, the EOF and the Capital Generation. Then we remind the main valuation methods that in the last 20 years have been used in the European equity markets for the Insurance Industry (P/E, Dividend Yield, EV/MCEV, FCF). After that, we show what the actual approach using S2 is based-on and how it is currently used. Finally, we underlie some critical issues and incoherence of the approach to determine a proper economic equity value.

We conclude that S2 data are valuable and provide insights but shouldn't be used, in our view, as a unique approach for equity valuation. We think investors should go through a much more comprehensive set of data to build a more stable and coherent framework in order to determine a fundamental economic value of equity capital.

2. Solvency II Regime: aims and structure

The introduction of the new prudential supervisory regime had different objectives[1]:

– Adopting a risk-based economic capital to better calculate and undertake all the different risks involved (technical, market, operating etc.);

– Creating a level playing field within the European Union;

– Increasing Policyholders' protection;

– Improving capital allocation within firms and groups.

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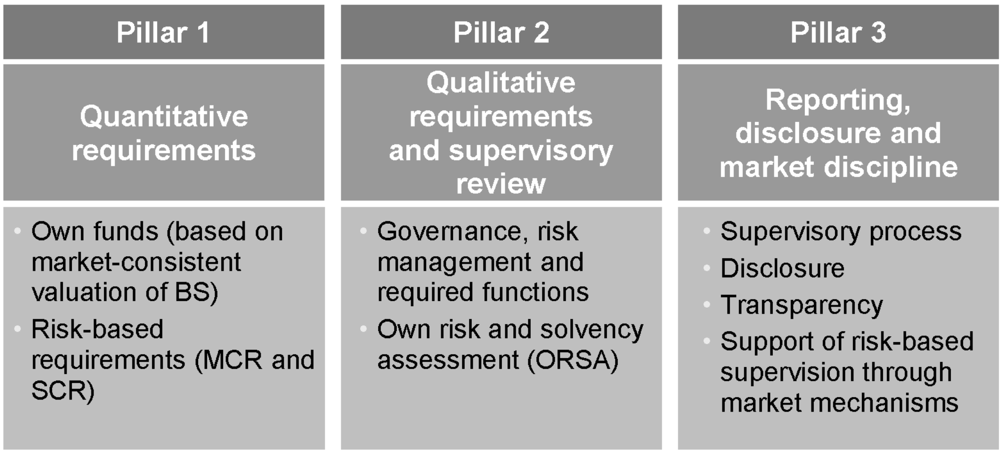
[1] Andenas M., Avesani R.G., Manes P., Vella F., Wood P.R., *Solvency II: A Dynamic Challenge for the Insurance Market*, Il Mulino, Bologna, 2017.

The new regime was built on three pillars: the quantitative aspects of risk exposure in Pillar I, the corporate governance issues in Pillar II and the risk transparency (reporting system) in Pillar III.

Figure 1: Solvency 2 three Pillar structure



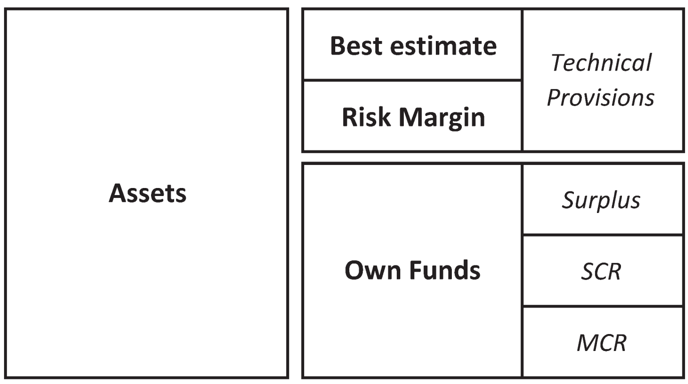
Source: Dalla Palma et al.

We focus here on Pillar 1, because it's the one producing the quantitative elements that are increasingly used for valuation purposes. We note that, starting from the second quarter of 2017, EU insurers disclosed also their Solvency and Financial Condition Reports (SFCR), in accordance with Pillar 3. This additional set of reporting is quite important in order to assess the strength and quality of the Solvency ratio, allowing market participants (and policyholders) to look at the capital situation of the main subsidiaries. Through this approach analysts and investors can dissect the positives and negatives of the single entities, trying to better discriminate the quantity and quality of capital at a group level (capital fungibility, cash remittances constraints etc.).

A mark-to-market approach

Importantly, S2 starts from an economic valuation of the entire balance sheet. It is based on a market-consistent (MC) approach, whereby assets and liabilities are valued at the amount for which they could be exchanged and transferred under regular market conditions. If the valuation methods of the international accounting standards (namely IFRS/IAS) differ from the market-consistent approach, the insurer should use other MC compliant methods.

Figure 2: Simplified S2 Balance Sheet



Source: Andenas et al.

As far as the valuation of Liabilities is concerned, the value of technical provisions has to be equal to the sum of best estimate and risk margin, where the former is defined as the probability weighted average of future cash-flows, taking into account the time value of money using the relevant risk-free interest rate term structure, while the latter is equivalent to the cost of capital the insurer is required to hold to take over and meet the insurance obligations throughout their duration.

Figure 3: Simplified comparison between IAS/IFRS and S2 accounts

Assets and Libilities	IFRS	S2
Property, plant and equipment	*Amortized cost/FV allowed*	*Fair Value*
Loans and receivables	*Amortized cost*	*Fair Value*
HTM Bonds	*Amortize cost/FV*	*Fair Value*
Other Bonds	*Amortize cost/FV*	*Fair Value*
Shares	*Fair Value*	*Fair Value*
Derivatives	*Fair Value*	*Fair Value*
Investments in subsidiaries, associates and JVs	*Cost/FV allowed*	*Fair Value*
Technical Provisions	*Prudent local standards, with shadow accounting lo limit ALM mismatch and technical liabilities*	*FV (absence of prudence)*
Financial Libilities	*Amortized cost/FV allowed*	*Fair Value (no adjustments for own credit risk)*
Scope of Consolidation	*All controlled entities*	*All controlled entities, excluding banking and non insurance entities are not consolidated in an insurance Griup*

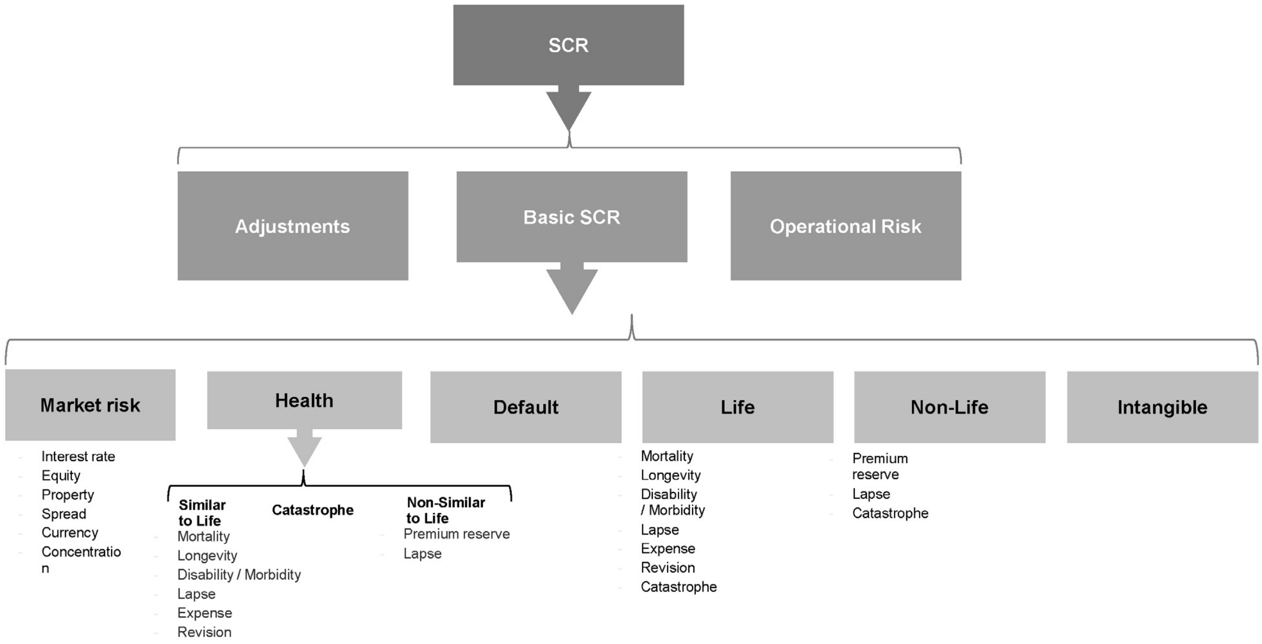
Source: Andenas et al.

Defining capital requirements

The Solvency Capital Requirement (SCR) is calculated as the amount of capital that insurance companies should hold to be able, with a probability of 99.5%, to meet their obligations to policyholders over the next year, thereby ensuring that a 'ruin' event will not occur more than once in 200 years.

In practice the calculation that the insurance undertaking performs is structured in six main modules and further into sub-modules. In addition to the classification proposed by the legislation, other risks taken under consideration are liquidity and ALM risk, sovereign risk, strategic and emerging risks, reputational risk and risks connected with group membership.

Figure 4: Risk mapping

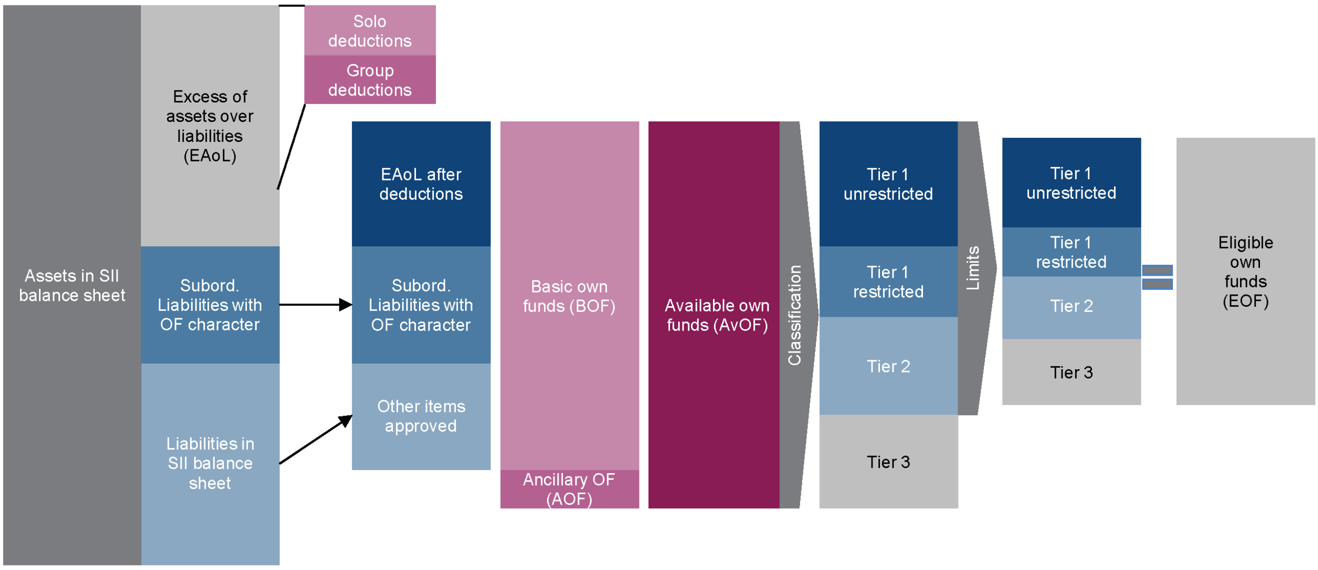


Source: Ageas

Defining available capital

Eligible Own Funds (EOF) represents the financial resources of the undertaking required to absorb losses related to the assumed risks. EOF consist of the excess of assets over liabilities, valued through a market consistent approach and reduced by the eventual amount of own shares held, plus the eligible subordinated liabilities (basic own funds) and the ancillary own funds (unpaid share capital, letters of credit and guarantees and any other legally binding commitments to undertakings). EOF should be classified into three tiers, depending on whether they are basic or ancillary and on the extent to which they possess some characteristics (permanent availability or subordination, considering the duration of the item and whether it is dated or not. In addition, the absence of incentives to redeem, mandatory servicing costs and encumbrances need to be considered).

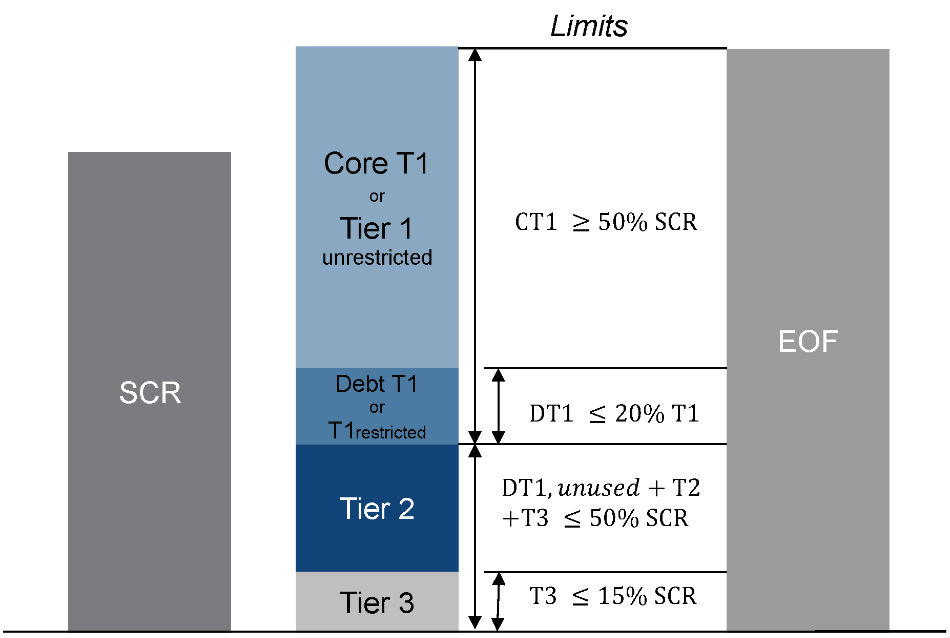
Figure 5: Eligible own funds flow chart



Source: Munich Re

In order to be compliant with the SCR, the EOF are subject to the following quantitative limits: Tier 1 must be at least 50% of SCR, Tier 3 must be less than 15% of SCR and the sum of Tier 2 and 3 must not exceed 50% of SCR. Additionally, the tier 1 must be at least 80% of MCR, tier 2 must not exceed 20% of MCR, while tier 3 and ancillary OF are not eligible to fulfil the Minimum Capital Requirement. The MCR is derived from the SCR and is calculated as a linear function of a set of variables like: technical provisions, written premiums, capital-at-risk, deferred taxes and administrative expenses, all net of reinsurance. It should not be less than 25% or more than 45% of the SCR

Figure 6: Tiering limits



Source: Munich Re

Long-term Guarantee measures and UFR

Within the market consistent framework the regulator introduced a number of non-economic measures. The common objective, with the exception of transitional measures aimed at giving the industry time to adapt to the new framework, was to recognize the long-term nature of the insurance business, particularly in relation to life contracts.

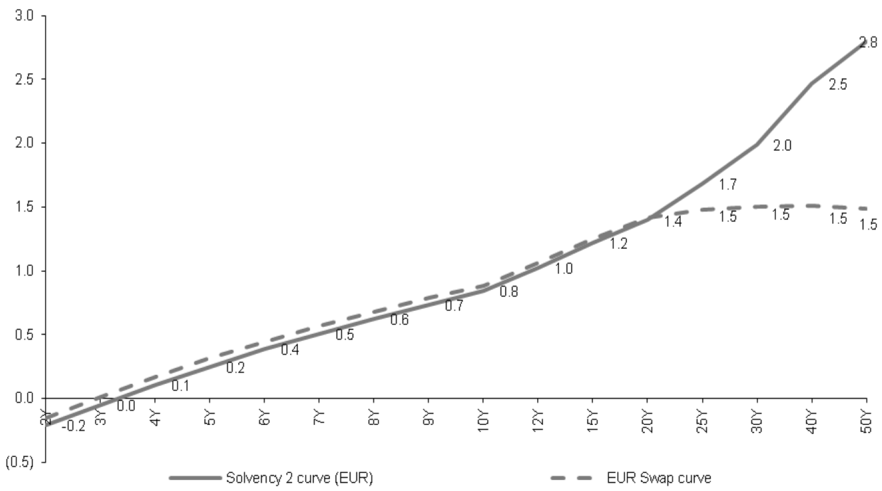
In order to absorb the impact of artificial volatility on long term contracts valuation – that is, a variation in own funds not linked to a change in the cash flows generated by a financial instruments, for instance due to a credit spread change not due to an increased issuer default probability – the regulator introduced the so-called Long Term Guarantee measures (LTG), two of which are not transitional: the volatility adjustment (VA) and the matching adjustment (MA).

– *Volatility adjustment*: a reference portfolio set by EIOPA is used to calculate an average spread of the asset portfolio vs the swap curve. Such spread, with an application factor of 65%, is added to the risk-free swap rate to discount liabilities. It allows capturing the illiquidity premium. The risk of default is separately considered.

– *Matching adjustment*: similarly to the VA also the MA increases the discount rate to reflect the illiquidity of liabilities. The main difference is that it is not based on the EIOPA reference portfolio and it requires a strict cash-flow matching between assets and liabilities since it is using the 'locked' asset yield to discount liabilities.

The other non-economic element introduced by S2 regulation is the Ultimate Forward Rate (UFR): from the last liquidity point (LLP) – 20 years for the EUR area, 50 years for Pound Sterling – a theoretical curve is extrapolated to obtain an ultimate forward rate of 4.05% (it started at 4.2%, but it will fade in steps to around 3.65%, based on the new calculation methodology) – that is a one year forward rate in year 60.

Figure 7: Swap Curve vs S2



Source: Bloomberg, EIOPA, Exane BNP Paribas

Capital generation components

The dynamic movement of the EOF and SCR in any given period can finally show the change in available surplus capital or capital generation of the business. In essence it is the S2 flow of net wealth creation.

Focusing on the unrestricted Tier 1 component of EOF (which is essentially a market consistent equity value), the flow from one year to the other can be summarised in the following components:

– The Excess Spread (return earned above the risk free rate);

– Non present value income streams (any income not capitalized on the BS as part of the best estimate, typically underwriting profits and fee income);

– Risk margin unwind (for policies that contain significant non-hedgeable risks);

– Operational result (above best estimate assumptions);

– Value of new business net of required capital;

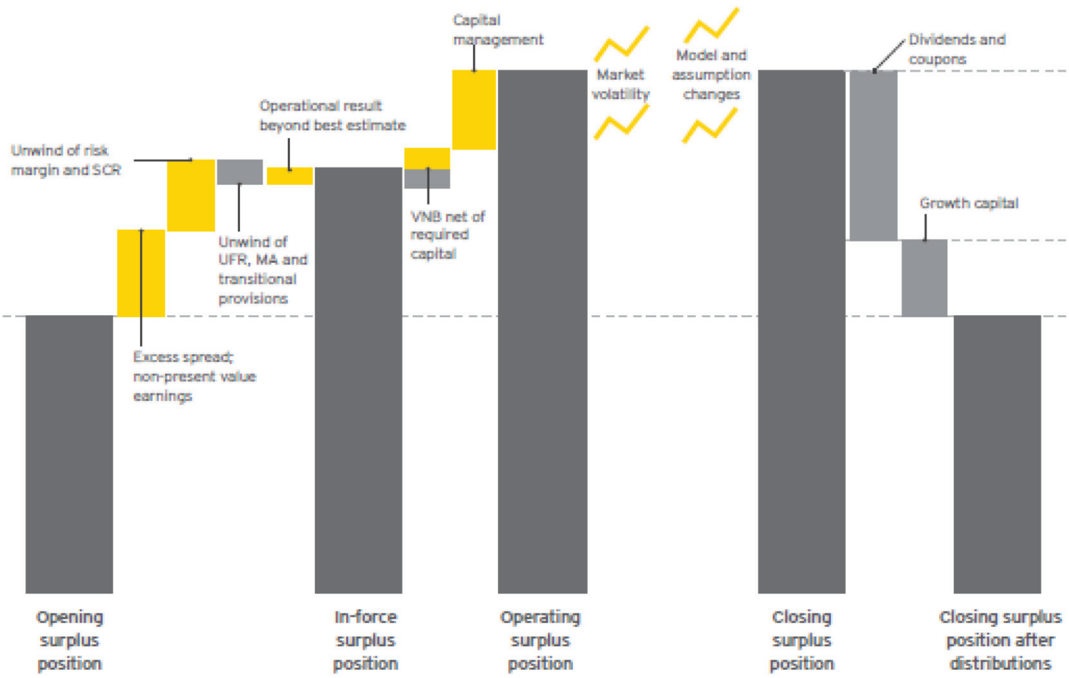
– Capital efficiencies;

– Market volatility;

– Model and assumption changes.

The net capital generation is then defined as the increase in unrestricted Tier 1 net of capital requirements to fund growth. Importantly, we note that listed insurance companies have sometimes adopted slightly different definitions of "capital generation" closer to "free capital generation", i.e. the capital generation over and above a certain level of target S2 – thereby implicitly using a multiplier also for SCR movements.

Figure 8: Sources of capital generation under S2



Source: EY.

3. Valuation approaches in the European Insurance Industry: a brief history

In the last 20 and more years, the topic of valuation in the insurance industry has been relatively complex, particularly in Europe and above all in the Life sub-sector, mainly due to the actuarial elements embedded in the process.

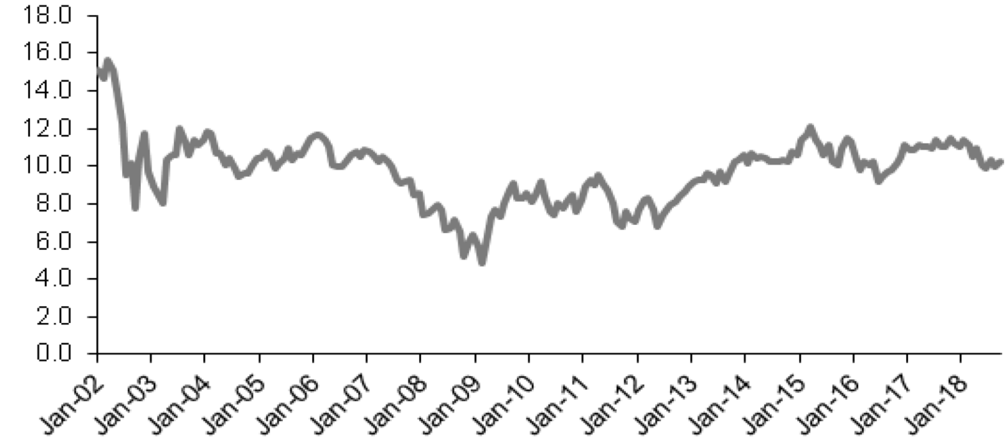
Starting from the basic principle that the equity value is the NPV of all the resources pertaining to shareholders in the future[2], the characteristics of the business and the specific issues affecting the accounting have driven a lot of different ways through which the market tried to assess the value of insurance companies.

The use of market multiples has always been present as a quick tool to compare the listed stocks, at least on a sub-group basis (life, non-life, reinsurance, asset management etc.) or applied under a sum-of-the-parts approach. Naturally, discrepancies in accounting principles among different countries and own company flexibility in reporting caused some inconsistencies. Having said that, the PE multiple (12m forward) has been relatively stable during the last 16 years, averaging 10x and, excluding the 2002 and 2008 levels (15x and 6x, respectively), ranging from 8x to 12x for the sector as a whole. Despite all the limitations and simplistic nature of the approach, we believe that relative valuations through multiples will continue to be used due to their easy back of the envelope nature. We at least recommend the application of some adjustments to the accounting figures employed to align for different policies and of course to put a strong effort in considering the comparability in terms of businesses/markets[3].

[2] Koller T., Goedhart M., Wessels D., *Valuation*, 6th Edition, Wiley, NY, 2015.

[3] Guatri L., Bini M., *I moltiplicatori nella valutazione delle aziende*, UBE, Milano, 2002.

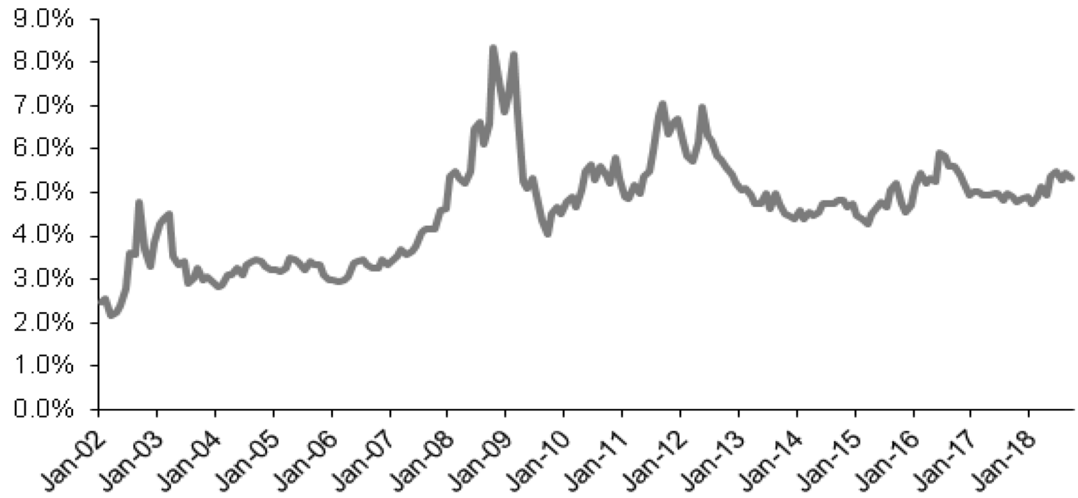
Figure 9: European Insurance Sector PE



Source: Exane BNP Paribas, Factset Estimates, MSCI

Given the positive cash generative nature of the business and the limited growth opportunities available in Europe, the Dividend Yield has increasingly become an important element in discriminating the attractiveness of listed insurance groups, in particular post 2008. In a prolonged low yield environment, the capacity of distributing sustainable cash to shareholders became a distinctive factor in all the asset allocation strategies in search for bond-type equities. The total yield of some stocks (Dividend + Share Buy Back) has been one of the major drivers of performance in recent years. The core dividend yield of the European insurance sector averaged 4.6% in the last 16 years, being between 4% and 6% in the last 10, in particular. While considering the cash generation capacity of a business a fundamental driver of its value, we think that a deep understanding of the nature of that cash is vital in building a sensible valuation of the equity capital. In particular, discriminating between stock and flow (that is, return on capital vs return of capital) is paramount.

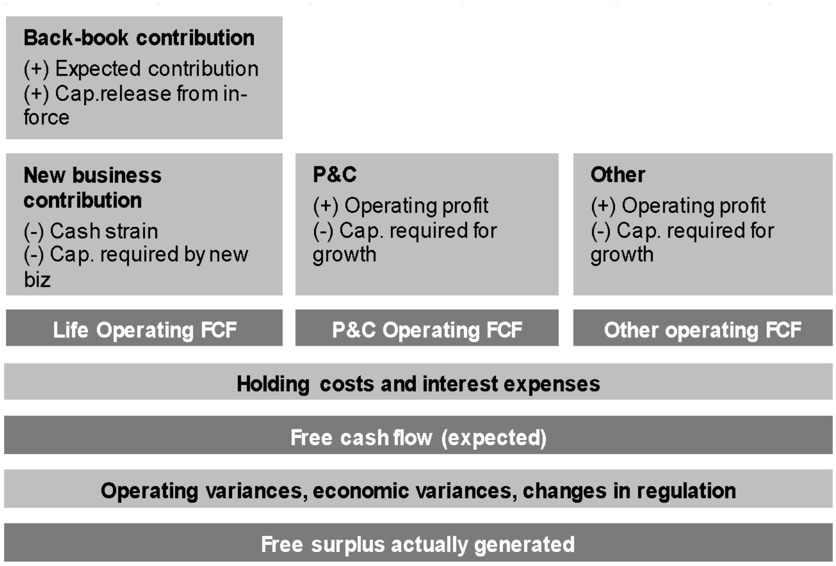
Figure 10: European Insurance Sector Dividend Yield



Source: Exane BNP Paribas, Factset Estimates, MSCI

Starting in late 90's, the Embedded Value (EV) approach became then a more common valuation framework[4]. At the beginning the approach was based on a building block analysis starting from the Tangible NAV of the company and adding to the latter the value of In-Force, corresponding to the NPV of future profits expected from the policies alive at the time of the valuation. The calculation was based on a deterministic DCF, adding on an NPV basis the net cash earnings generated by the portfolio run-off, using normalized assumptions (on asset yields, maturities, redemptions, cost of capital etc.). The determined EV was actually the value of net assets in place, from which, adding an estimation of the NPV of the future new business, we got the equity value under an appraisal value method. In those days, a simplified approach consisted in applying a multiple on the value of new business of the most recent year, to determine the goodwill (the value of future growth opportunities). In so doing, the market was effectively capitalising a NPV flow, exploiting the risks of overestimating growth for a large number of life companies[5], something that became evident during the bear market period after the dot-com bubble. Starting from the EV framework was also common practice calculating the Free Cash Flow yields, where the FCF was based on the free surplus generation. The TNAV component of EV could in fact be broken down in two components: required capital and free surplus. The advantage was that it allowed excluding any future profits from the free cash definition. Among other inconsistencies, anyway, it's worth mentioning the fact that neither the definition of required capital was coherent across companies, nor were the EV methodologies and the level of disclosures.

Figure 11: FCF definition in the EV world



Source: Exane BNP Paribas

In the context of ever decreasing interest rates coupled with reduced equity and real estate values, another issue started to emerge. Given the common practice of guaranteeing returns on life policies, the compressed asset yields moved closer to the minimum guaranteed levels, thus affecting the reliability of a deterministic approach with normalised asset yield assumptions in assessing the real value of portfolios. The actuarial profession came to rescue then[6], proposing a stochastic approach in valuing the run-off, using more sophisticated models to take into account the likelihood of obtaining yields lower than the guaranteed return and proposing a tool to consider that scenario, pricing it through proper option models. In a much more volatile market environment, both listed insurers and the analyst community moved to a more market consistent configuration of value, arguing that a simple deterministic approach of a standard DCF was not representative of the contingent actual pricing conditions at any point in time. The European Embedded

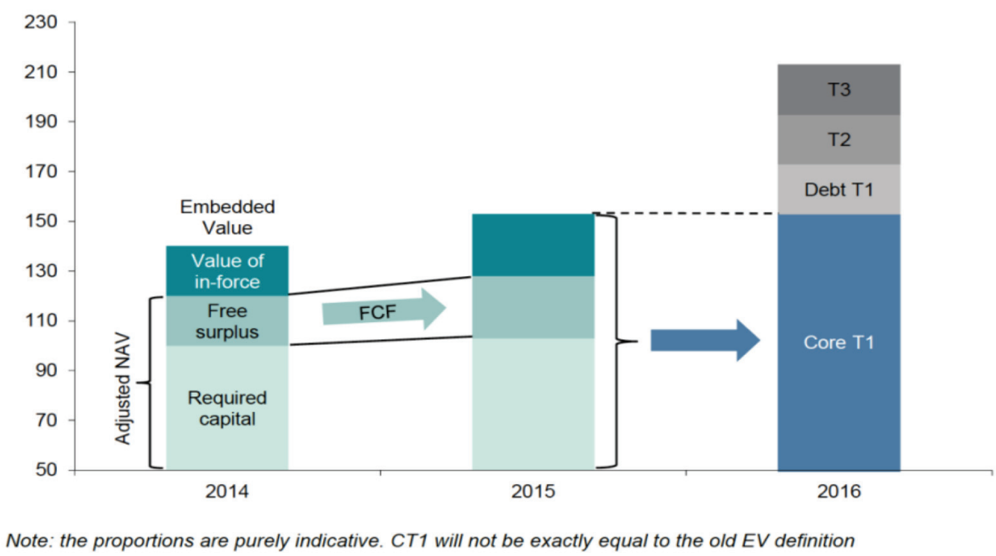
[4] Massari M., Zanetti L., Gianfrate G., *The Valuation of Financial Companies*, Wiley, NY, 2014.
[5] Giuliani S., *Crescita e Valore*, Aracne, Roma, 2005.
[6] De Felice M., Moriconi F., *A Course on Finance of Insurance*, GCAF, Università Cattolica, Milano, 2002.

Value first, and the Market Consistent Embedded Value later, came into force as the new valuation paradigm. With this further step, all the assets and the liabilities were valued on a market consistent basis, thereby exploiting the use of complex modelling and involving directly the companies in the valuation process. That element induced of course a clear reliance of the equity market on the numbers produced directly by the finance and actuarial divisions of the firms, changing at the margin their incentives in feeding the analysts and investors with the "right" set of numbers coming from their internal models[7]. Of course, that created a hiatus between the production of primary information and the capacity of the market to properly elaborate and challenge it. After a period of relative acceptance, the 2008 crises put a lot of pressure also on the new approach. Adding to the issues just mentioned on the reliability of numbers, all the actors had to suddenly recognize that a pure MC approach was probably too volatile for a relatively stable long term business, whose liabilities are practically not callable (so with low liquidity risk) and whose leverage was not that high (at least versus the banking industry. Typical net asset leverage used to be 20-25x for banks vs 5-6x for Insurance companies). When the reported figures after the crisis started to emerge, we had cases of MCEVs halving in just 1 year, pricing the extreme market conditions at that time as they were "fair" and therefore applied for the overall duration of the business in force (in most cases longer than 10 years). Of course this kind of volatility and pro-cyclicality fostered doubts on the solidity and adequacy of the approach for this kind of businesses; as a consequence, it started to become less and less used as a primary valuation tool. After a period of mixing different approaches (the EV was again coupled with PE and dividend yield), since 2016 we are witnessing the emergence of a new era, that is to value the equity of the Insurance companies following the new S2 framework.

4. Solvency 2 as an Equity Valuation Tool

With the advent of the S2 framework we have witnessed an increased usage of S2 data for valuation purposes. Three kind of metrics have been in focus. They resemble but are conceptually different to the free surplus based FCF definition in the 'EV world'.

Figure 12: From the EV to the S2 world



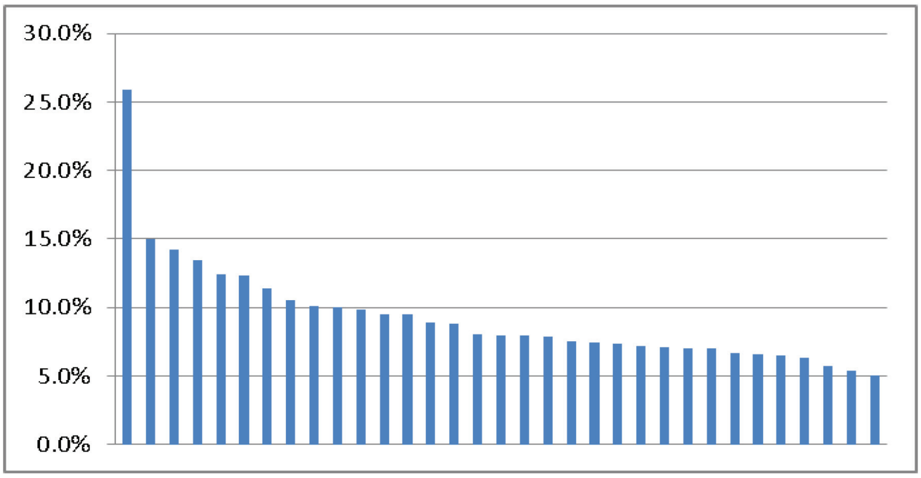
Source: Exane BNP Paribas

1) *Capital generation yield*: sometimes misleadingly called cash flow yield, the S2 derived capital generation as percentage of market cap can be compared across companies. For 2017 we find the sector average stood broadly around 10% (with a 5-15% range). The underlying assumption is that S2 capital generated can be paid out in dividends or reinvested in growth. Importantly we note that companies do not disclose ca-

[7] Giuliani S., Lualdi M., *L'Introduzione dello EEV nel Settore Assicurativo: Aspetti Critici*, la Valutazione delle Aziende, n. 35, 2004.

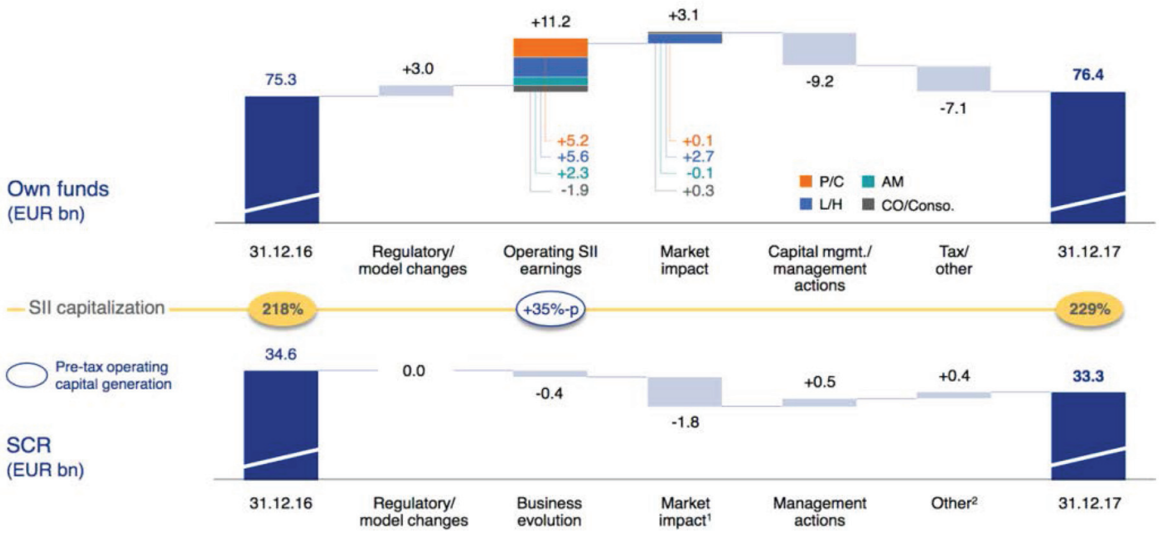
pital generation based on the underlying components (excess spread, new business value, etc.) but rather on an aggregate basis. The definition and presentation of "underlying" or "normalized" capital generation is moreover not always the same.

Figure 13: Capital generation yield 2017



Source: Company data, Bloomberg

Figure 14: Sources of capital generation under S2 – disclosure view

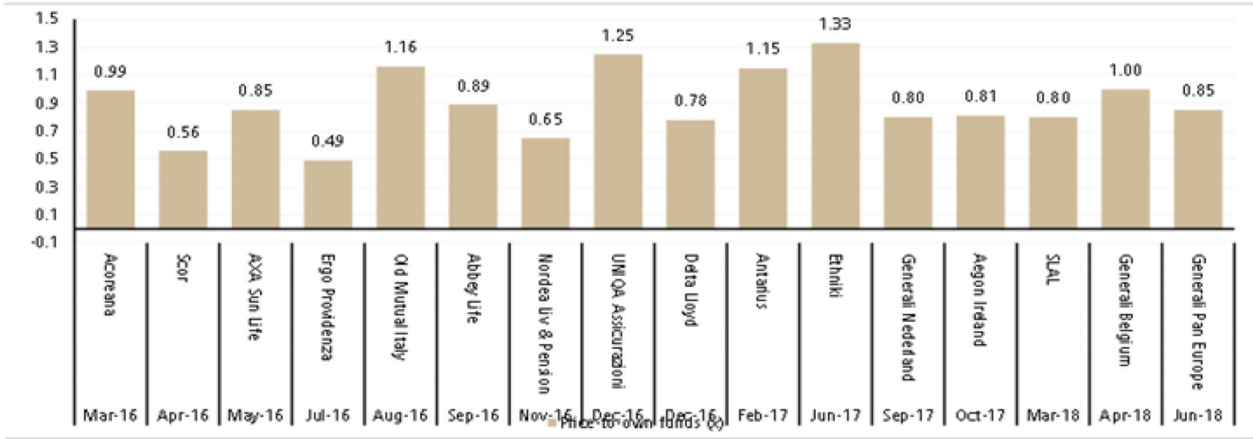


Source: Allianz

2) *Free capital generation yield*: a variation of capital generation yield it reminds of the FCF methodology stemming from the EV disclosure earlier described (effectively, a free surplus generation). The main difference to the simple capital generation yield is that it only captures the 'free' capital generated over and above a certain target capital level – the market practitioner shall set his own target capital level, or use the company basis. Importantly, the difference to the EV based FCF is that all capital generated above a certain level is captured, not just the tangible capital.

3) *Price-to-T1 ratio*: more specifically price-to-unrestricted Tier 1 as a proxy for price-to-EV. This approach has mainly been used for transactions on life companies – particularly in the case of life back books.

Figure 15: P/EOF for some recent transactions



Source: PwC and SFCR Reports

The average multiple at which the deals showed have been closed in the last 30 months is 0.9x EOF. In the same period the European Insurance Sector traded between 0.8x and 1.0x EOF on average, if we exclude some P&C names with low capital needs and high returns like the UK and Scandinavians. With all the caveats related to the comparability between the group of deals and the listed companies, we can nonetheless notice a similar level of valuation for M&A transactions and minority financial holdings. The ideal gap between the two (namely the synergies and premium for control, typically at the 25-30% level) seems not to be present. We think that's something to deepen in future research, understanding if the hiatus can be related to the fact that the market is underestimating some risks in pricing current businesses or if most of the delta is due to sample differences and the structure of EOF.

5. Critical issues

In this section we highlight some of the critical matters we see in the use of S2 inputs for valuation purposes. The over-arching issues are the cash-conversion of capital generation and the degree of market consistency in the S2 balance sheet. We note that these topics are more significant for the life industry, due to the structurally long-term nature of the business.

Stock and Flow

The fundamental value of equity capital is the NPV of all the resources pertaining to shareholders – free cash flows to equity – in the future. S2 flow (capital generation) is one of the drivers of cash, but it is not cash. S2 equity stock (unrestricted Tier 1) is a proxy for mark-to-market net asset value, but the P/NAV based valuation is only relevant if there is a strong link between RoNAV (return on net asset value) and dividend capacity: the relationship of P/BV = (RoE – g)/(CoE – g) is ultimately driven by the Gordon Growth Model.

The following critical issues shall be considered, in our view:

1. 'Going concern' regime and risk-margin calibration: Contrary to S1, S2 introduces a 'going-concern approach': insurers determine their financial requirements under the assumption that they will continue to operate and write new business for the foreseeable future. The going-concern regime seeks to ensure that if a firm does go out of business, policyholder protection and continuity of insurance cover are sustained. To achieve this, S2 introduces the 'risk margin' – a provision that increases the best estimate of a firm's insurance liabilities to produce a market-consistent value[8]. The risk margin is calculated using a cost of capital of 6%. The European insurance association argued a more appropriate calibration would be 3%[9]. "Although the cost of capital approach was selected on grounds of relative simplicity, it requires an annual projection of SCR for the full run-off period of the liabilities, which is anything but straightforward for many insurers. To calculate SCR accurately at each future duration requires complex projections and this is impractical for many insurers' models. This difficulty is recognised within EIOPA guidance, which has set

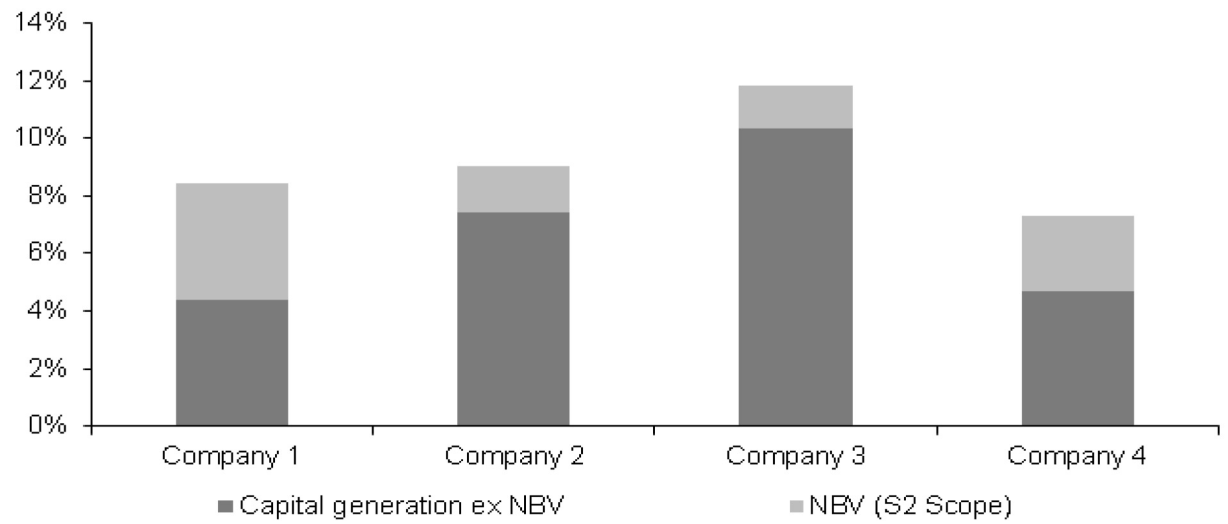
[8] Swain R., Swallow D., *The Prudential Regulation of Insurers Under Solvency II*, BOE Quarterly Bulletin, Q2 2015.

[9] Insurance Europe, *Insurance Europe comments on the review of the Solvency II risk margin*, 2017.

out a number of simplified methods. Unfortunately, these methods do not appear to be sufficiently accurate in many cases. One robust approach to this problem is to define, for each block of business and for each component of SCR, an appropriate 'risk driver' which is output by the model, so that it is assumed that this component of SCR moves proportionately to the driver. For example, for the mass lapse component, the risk driver might be the excess of total surrender values over total BEL in each future year. The projected SCR is then determined in each future year by combining the individual elements in the normal way. This approach requires both analysis and understanding of causes of risks and significant testing"[10]. Investors may of course have different views on either the methodology for the risk-margin calculation or its calibration.

2. S2 flow includes future profits: Future profits that Embedded Value captured in VIF (stock) and NBV (flow), are also implicitly recognized in the S2 own funds and capital generation. The first issue is that S2 own funds generated are equal to the net present value of distributable profits only under strict conditions[11]. The second (related) issue is that own funds generated in a given year are not a proxy for free cash or dividend capacity of an insurer in that given year. Capital generation shall rather be seen as the constraint to dividends than the only driver of dividend capacity. Understanding the cash conversion profile of the capital generated is therefore crucial and only very few insurers have given guidance on how the new business value translates into distributable earnings or how the capital generation itself breaks down. These differences in how the capital generation is built have to be properly assessed during the valuation process. As can be seen, the reliance of Capital Generation on up-fronted future profit can be very different.

Figure 16: Future profits in Capital Generation



Source: Company data

3. Re-risking is neutral (the spread issue): Increasing asset risk will increase the capital generation as the insurer will earn a higher spread over risk-free rate. While this will be visible in the higher capital consumption the year of re-risking (although highly tempered by diversification effect), thereafter it will lead to a higher annual capital generation. This in turn requires a higher cost of equity. We believe it may be difficult for market participants to correctly adjust for small differences for different players, while a look at the market risk requirements should provide investors with a steer towards the net market risk exposure.

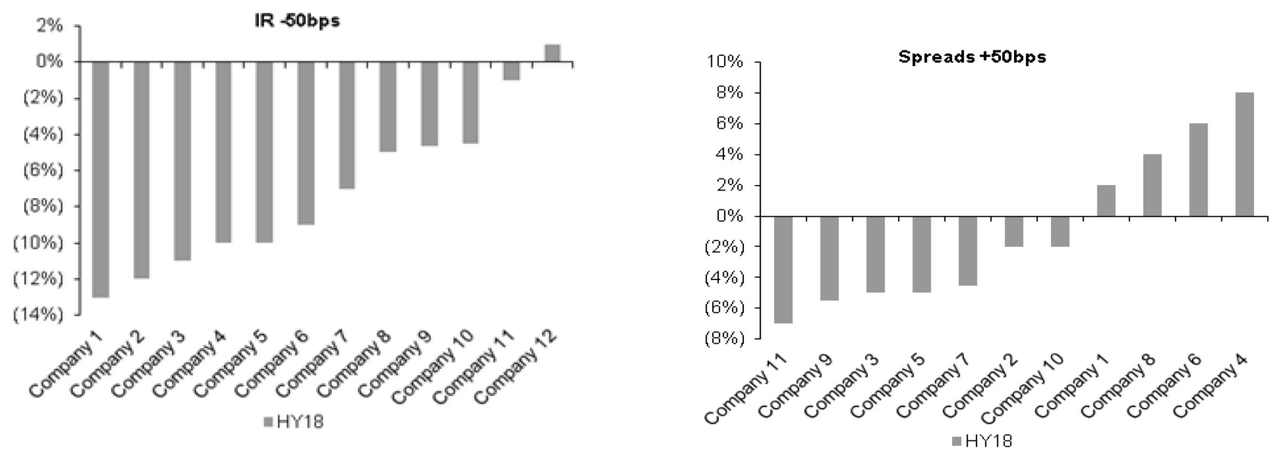
4. Mark-to-market impact on stock vs flow (commingle): The impact of mark-to-market is often a significant driver of S2 ratio swings, which the market tends to anticipate. Many listed insurers provide simplified sensitivities to movements in interest rates, spreads, FX, equity and other key market factors. These can be applied to the S2 stock. However, we would argue that given the dominant hold-to-maturity

[10] Rae D., Barrett A., Brooks D., Chotai M., Pelkiewicz A., Wang C., *A Review of Solvency II – Has It Met Its Objectives?*, Institute and Faculty of Actuaries, May 2017.

[11] Kent J., Morgan E., *S2AV: A Valuation Methodology for Insurance Companies under Solvency II*, Milliman, 2016.

model, for well-matched portfolios the movements should be minimal, except for the part impacting the free portfolio. And when there is asymmetry due to regulatory adjustments, the capital movement should not be valued 1-for-1 in the fair value assessment. Strictly related to this issue is the focus on capital generation guidance from companies, which is very basic at this stage (often a range S2 points expected to be generated per year) and lacks any sort of either auditing and comparability or sensitivities to market factors. We believe market participants shall therefore pay close attention to how swings to S2 capital (stock) translate into higher or lower S2 capital generation (flow).

Figure 17: Solvency Sensitivities



Source: Company data

The intrinsic commingle between stock and flow of the S2 framework can lead to significant distortion in the equity valuation, especially when participants treat the delta between reported S2 ratio and pre-set target as excess equity (valued separately at face value) and then add to that a multiple of annual capital generation. For example movements in spreads arguably have very limited impact on the real free cash flow generation of an insurance group as bonds are typically held to maturity to match liabilities duration; ultimately a positive delta on EOF stemming from spread narrowing will be compensated by a lower capital generation in the future as the positive mark to market in the stock is largely an up-front. To the extent that market participants are not provided with the relevant information on the intrinsic commingle between stock and flow in relation to spread movements, it is very easy to get a 'distorted' equity valuation as the flow used is backward looking and hence not reflecting what has been recognized and up-fronted already in the stock.

5. *Run-off valuation (the fixed costs issue)*: transactions on back books in run-off have so far largely taken place at a price below unrestricted Tier 1. This rightly reflects the fact that the framework is based on a going-concern view. This implies that cost-assumptions are not reflecting a run-off / closed business and the only way to offset this would be to have a fully-variable cost base or to integrate in the best estimate of liabilities the explicit 'exit costs' besides the cost of capital to run-off the liabilities already captured in the risk margin. This raises a note of caution for the adoption of multiples of annual capital generation in the equity valuation as clearly distinction should be made between the elements of capital generation that are durable and sustainable and those that are more one-off in nature like the release of solvency capital from business running off.

6. *Acquisition valuation (synergies capitalisation)*: in case of M&A transactions the acquirers typically consolidate the target with a look-through view on the future estimated cost base of the combined entity. This means *de facto* a capitalization of estimated future synergies to be extracted; hence, market participants need to be careful in avoiding double-counting by adding to the initial 'flow' of the combined entity capital generation the targeted synergies of the merger plan as at least part of the latter could already be recognized in the opening stock of S2 capital of the merged group.

Non-economic distortions

S2 is a regulatory framework. Its main objective is therefore not the valuation of insurance equity but the protection of policyholders. In order to avoid excessive pro-cyclicality of regulation, leading insurers to be asset sellers at times of asset stress and buyers of assets at times of bubbles, the regulator introduced a number of non-economic counter-cyclical adjustments (mostly known as LTG measures) to reflect the illiquid nature of a large part of insurers' liabilities and therefore the ability to have a hold-to-maturity model on the asset side. The regulator also allowed for transitional measures from S1 to S2. Lastly: some policyholder assets can contractually and legally be used to absorb policyholder losses – these are included in insurers' own funds (uT1), but do not pertain to the shareholders.

The following critical issues shall be considered, in our view:

1. VA/MA adjustment: The volatility adjuster uses a credit-adjusted spread over an EIOPA determined reference portfolio with an application factor of 65%: however companies do not own the reference portfolio (which is calculated as the average portfolio for the European industry) and the application factor is arbitrary. Some companies moreover use dynamic volatility adjusters, with methodologies leading to different outcomes with significant impact on the level of the SCR. The matching adjustment uses a fundamental spread to capture the risk of default and rating downgrades. In order to apply the MA, the insurer needs to have a cash-flow matched portfolio and in some cases this is achieved through the use of SPVs which circumvent regulatory requirements. Ultimately the aim of the VA and MA adjustments is to provide insurers with a countercyclical buffer to reflect the illiquidity of liabilities and the hold-to-maturity model for assets. Once again these factors impact the capital constraint on free cash to equity holders rather than making capital generation a better guidance of distributable cash. Basing the value of a fixed cash flow liability on the assets backing it and recognizing on day one the unearned illiquidity premium is clearly not market consistent. Importantly, a movement in the VA over a given period is ultimately driven by what is held in the industry reference portfolio; as such, we observe changes in the value of the BEL and hence the residual equity value of a specific undertaking that are not linked to the actual company's future dividend paying capacity.

2. The Ultimate Forward Rate (UFR): The UFR has a strong impact particularly for the currencies with an early Last Liquid Point (LLP), namely the EUR at 20 years. At current interest rate levels it lifts upwards the S2 curve from the LLP. The objective of the UFR is to reflect the long-term nature of life insurance liabilities and to offset deviations of interest rates from the long-term average (based on the average nominal interest rate since 1961, rather than a moving average). The equity investors may however have different views on the direction of interest rates based on their market view and investment horizon. In that respect the UFR can significantly distort the valuation of long-term liabilities, particularly in the EUR-area and for retirement products and hence alter the economic view of the real equity value for shareholders. Ultimately it can be seen as a 'zero cost' form of capital borrowing which needs to be unwound over time as we move closer to the LLP. A valuation technique that treats excess S2 equity vs a set target at face value without discriminating for the weight of the UFR benefit in the stock and then adds a multiplier to the annual capital generation would typically overstate fair value of long duration life and pension books, as the multiple applied to the flow which includes the negative annual UFR unwind (typically 10x) is way smaller than the actual implied 'capitalization factor' of the UFR contribution to the stock of EOF (often over 20x the annual unwind).

3. Transitional measures (on interest rates and reserves): transitional measures were implemented to allow a smooth transition from S1 to S2. They reduce the constraints on capital available to the shareholder, but do not impact the actual cash profile of the business. Recent research based on market data shows that there is a positive market appreciation for Solvency 2 ratios that are not relying on transitional measures and a negative correlation for movement in capital requirements[12]. In some jurisdictions, regulators feel pretty comfortable in considering "transitional capital" as fully distributable (eg. PRA in UK).

4. Equity charge adjustment: the equity dampener objective is to lower the equity charge at market troughs and increase it at market peaks, to incentivize countercyclical behavior when it comes to equity investments. Given the weight of equity investment, this should be relatively marginal in terms of net capital generation – but it is one of the many dynamic factors in the SCR calculation.

5. Policyholder buffers (e.g. the German RfB case): unrestricted Tier 1 funds can include loss-absorbing policyholder reserves. This is the case of the free Germany RfB, considered surplus fund within the S2 basic own funds. The loss absorbing capacity drives the classification as unrestricted Tier 1, but ultimately the free RfB represents funds reserved for policyholders' future surplus participation but not yet allocated to individual contracts[13]. This is S2 capital that does not belong to the equity investors.

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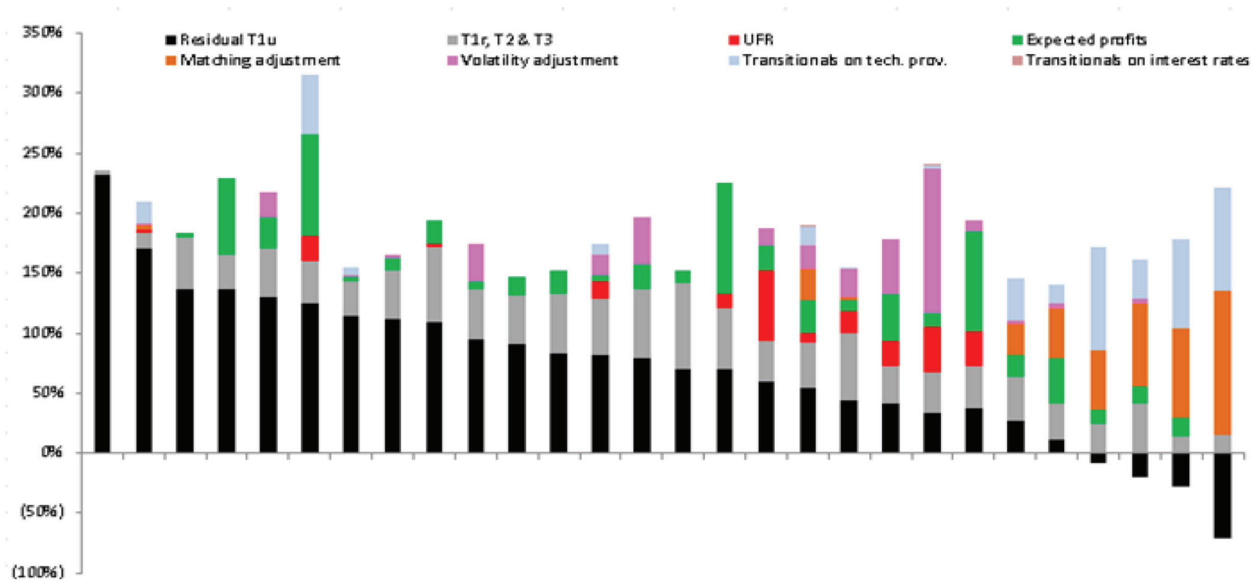
[12] Gatzer N., Heidinger D., *An Empirical Analysis of Market Reactions to the First Solvency and Financial Condition Reports in the European Insurance Sector*, Working Paper, School of Business and Economics, FAU, February 2018.

[13] Burkhart T., Reuß A., Zwiesler H. J., *Allowance for Surplus Funds under Solvency II: Adequate reflection of risk sharing between policyholders and shareholders in a risk-based solvency framework?*, European Actuarial Journal, Issue 1, 2017.

Figure 18: Weight of Transitionals and LTGs in S2 ratios of main listed European Insurance companies



Source: Company data; Autonomous Research

As can be appreciated, the composition of the S2 capital can vary to a great degree, depending on the different country, lines of business and regulatory approaches. Therefore, the capacity to pay free capital to shareholders has to be linked to the nature of the capital available (hard vs soft, current vs future) as well as to the nature of the capital generated (cash/ non cash).

Modelling and target capital

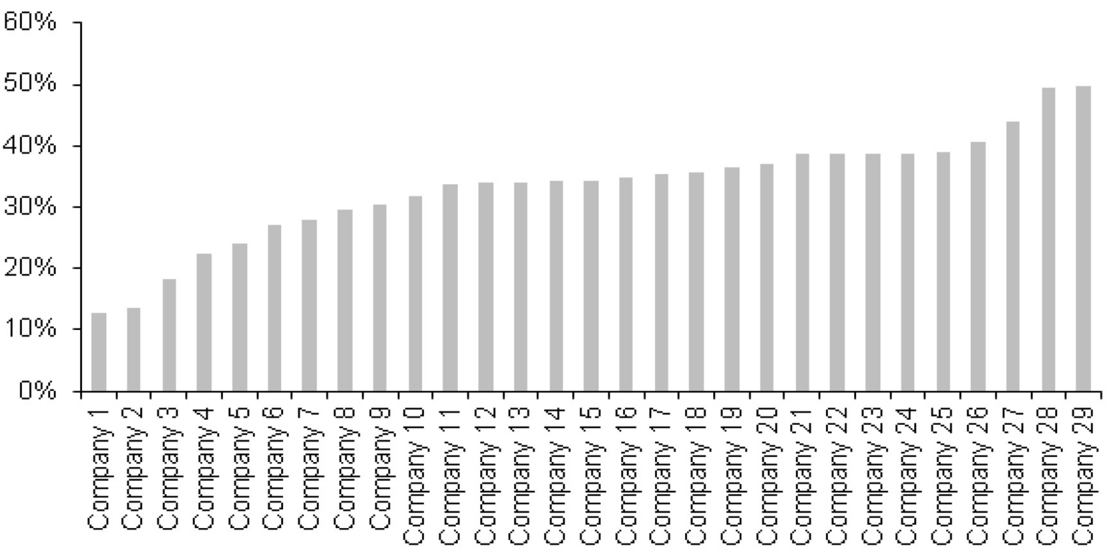
Using S2 for valuation purposes requires focusing on free capital over and above the SCR. This means that the calculation of the SCR is a key driver of free capital and any modelling difference between companies can have an impact on valuation. On one hand what the regulator sees as the SCR is what matters, on the other hand investors shall be aware that one of the objectives of EIOPA (the European regulator) is to drive convergence. So some differences could be softened over time and may impact the view of free capital.

The following critical issues shall be considered, in our view:

1. Standard vs Internal model: the SCR output from an internal model (or partial internal model) will in most cases be better than the standard model. Insurers are not obliged to use the internal model and will therefore only do so when it is to their benefit, given the costs involved in developing one and demonstrating to the regulator that it provides a better reflection of the actual risk profile of the company. The same business can therefore end up having a different capital consumption and net capital generation depending on which model is used. Once again the capital framework is the constraint on dividend capacity rather than the driver of dividends. The equity investor shall therefore take a view on the reliability of the internal model – in other words: will the regulator drive a convergence back towards a standard model approach over time or is there a true reason for the regulator to allow for the internal model approach for the foreseeable future? One topic that can have a relevant impact on a fundamental valuation is the nature of the so called “management actions” on the SCR. Basically the process can be split in two distinct groups: economic actions and modelling actions. The first one is linked to the decisions made by the management to change the overall risk profile of the business, being on the asset side (eg. reducing more risky asset vs less risky ones) or on the liability side (eg. changing product features in either the inforce book or the new business). The second one is based on “optimizing the model” (eg. changing risk modules or correlations, changing input estimates, moving to corporate structures linked to internal capital arbitrage etc.) with the only aim of reducing SCR, even if the true economic impact of these actions is nil. Looking at the period since the S2 framework has been introduced, we can note an yearly average growth of SCR of 3%, or 0% if we exclude 3-4 specific cases, versus an EOF CAGR of 5% (or 2-3%, like for like). The separation between the “economic management actions” and the “modelling management actions" has to be considered a fundamental qualitative tool in the valuation process, we think.

2. *Internal model vs Internal model (the diversification benefits issue):* Internal models can be different between companies, leading to different outputs. While sometimes this is driven by different underlying volatility of the actual insurance risk, in other cases it can be driven by a different calibration of the correlation factors driving different diversification benefits. A key question for the equity investor is weather this sort of difference is 'sustainable', therefore supporting different constraints on free cash flows. As we can see from the following picture, we have different level of diversification effect, linked to business, country and asset mix. Given that from the outside is extremely difficult to properly assess the solidity of the model (particularly in terms of correlation matrix), we can try to increase the quality of the valuation process looking at two things: firstly, trying to compare different benefits for similar companies, or similar benefits for different companies (at least that shows some potential relative inconsistencies) and secondly studying some company break-up cases to try to dissect the real impact of the "loss of diversification" out of modelling. Some of the common pitfalls of internal models recently observed are: burdensome documentation requirements, herding, supervisory overlay calibrations, more complex governance framework, non-level playing field vs standard formula and over-complexity [14].

Figure 19: Diversification Benefits in S2 Models



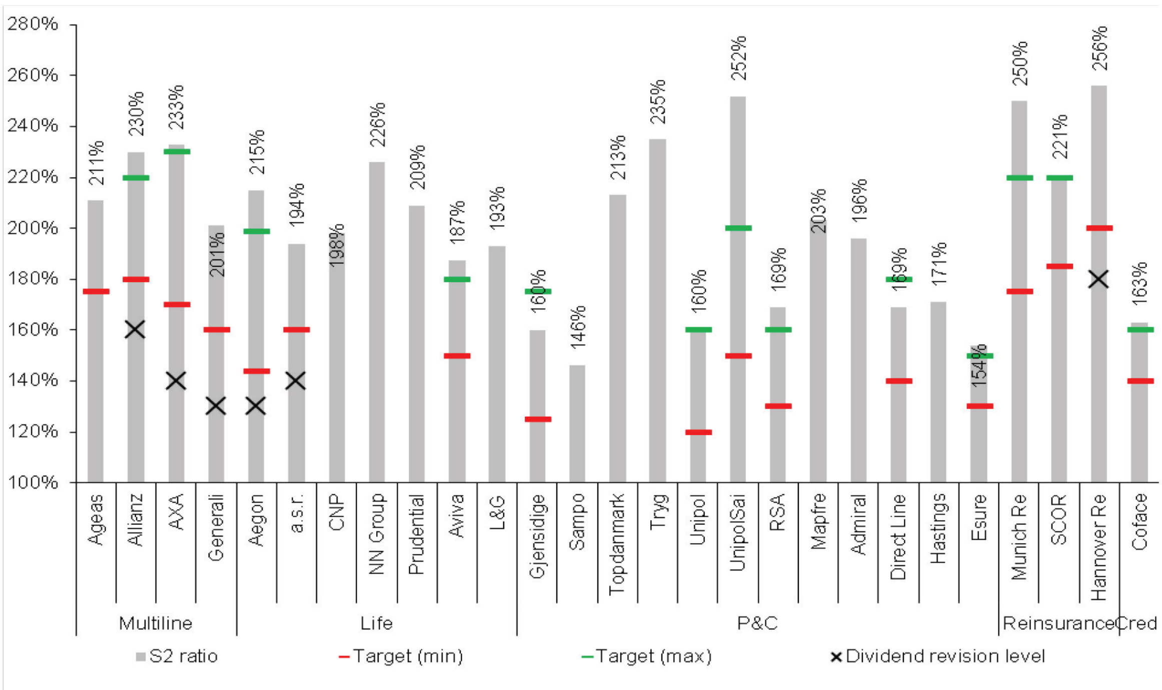
Source: Company data

3. *What is the optimal Solvency target?* Net capital generation is defined as the increase in unrestricted Tier 1 net of capital requirements to fund growth. A key question however is what the actual target capital level is: the regulator demands 100% coverage of the SCR. In practice companies will be under strict surveillance before they reach such level, both by regulators and equity / debt investors and to some extent also policyholders and counterparties. Different business models and different geographies can however lead to different choices in terms of target capital levels: a retail P&C business can in most cases run with a lower ratio than a commercial P&C business. A life business with high market risk and investment guarantees may require a higher ratio than a simple term life operation with no investment guarantees. Corporate structure, capital and cash pooling and geographical presence may be other factors influencing target capital levels. Ultimately the target capital ratio is something both management and the equity investors shall take a view on, in order to generate a better assessment of the net capital generation. Looking at the current solvency ratios of the European companies and comparing them to their target range, we notice an excess in the region of 15-20%. A superficial approach could be to consider this excess free to be distributed to shareholders (at the

[14] Rae D., Barrett A., Brooks D., Chotai M., Pelkiewicz A., Wang C., *A Review of Solvency II – Has It Met Its Objectives?*, Institute and Faculty of Actuaries, May 2017.

end of the day, that's the level above the company's target, and it should take into account all the systemic and idiosyncratic risks involved). In reality part of the S2 movements can be predicated on non-economic factors and not always an economic change in solvency is related to actual cash. In order to discriminate between a distributable free excess capital situation and a weaker one, we need to go through all the analysis we are trying to underlie.

Figure 20: Solvency ratios: actual vs targets



Source: Company data

Disclosure & comparability

S2 has significantly increased the level of disclosure. The Solvency Financial Condition Reports (SFCR) are mandatory and publicly available for all groups and for each subsidiary. Quantity of disclosure is however not a guarantee of full comparability across the sector: for example, so far many companies have given a view on "normalized" capital generation, albeit definition varies by company.

The following critical issues shall be considered in our view:

1. "Underlying" or "normalized" capital generation: in order to better understand the underlying drivers of capital generation, some companies have given a view on "underlying" or "normalized" capital generation. Such information is indeed useful, with some caveats: comparability between companies is limited by the different definitions – the "normalized" market return assumptions can differ, model changes are treated differently and so are management actions. On the SCR side the target capital ratio used as a multiplier for the SCR is also not always consistent (although generally set at 100%). The issue is not dissimilar to the comparison of "operating" or "adjusted" earnings. To be more specific, we neither have the disclosure around the 'normalized' asset yield assumptions driving the excess spread nor around the operating and actuarial assumptions behind new business profits and operating return vs. current experience.

2. Group vs subsidiary view: group capital and capital generation are most scrutinized. While they represent the constraint on free cash flows for the group, they are not always informative of the subsidiary view and the potential bottlenecks that can be found at a local subsidiary level and that therefore constrain cash remittances back to group. One example is the diversification benefit on which the groups rely on – but such benefit is not always "payable" to shareholders if the risk is taken in different legal entities.

3. Aggregate view vs LoB: capital generation disclosure, where available, remains very high level and can hardly be broken down in detail by line of business (LoB) for multi-line companies.

4. Non-S2 operations: for operations included in equivalence under Solvency 2, the capital generation can differ even more from the quasi-economic view of S2 and the price-to-capital ratio would be including a part of the business on a S2 basis and a part based on different regimes (e.g. US RBC) – leading to a further reduction in comparability across the sector.

5. Assumptions (e.g. P&C reserves prudence, duration): for the asset side the market-value concept is relatively simple, with the only exception of non-liquid or less liquid assets. The best estimate of liabilities does instead include a significant number of assumptions made by the company: while all of these have to be justified to the regulator and backed by actuarial reviews – the equity investor has little visibility and limited ability to compare methodologies and assumptions between companies. This problem is common to IFRS disclosure at this stage, albeit the forthcoming IFRS 17 accounting principle seeks to improve disclosure precisely on the key drivers of movements in liabilities.

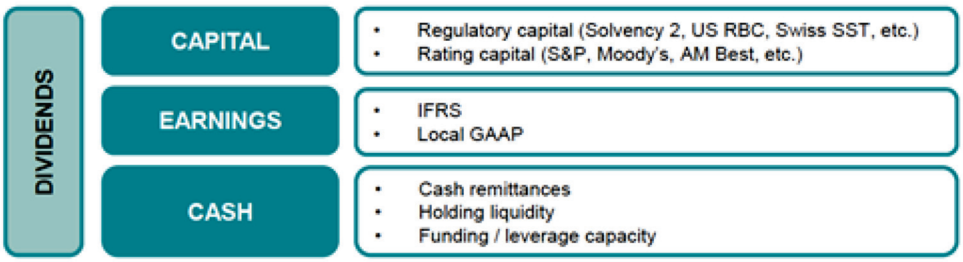
Auditing

Last but not least, we note that one of the major obstacles for the use of S2 data is its auditing. The information is audited only once a year by the regulators, whose objective is to protect policyholders as much as possible rather than providing investors with comparable information. This is instead the objective of the IASB when setting IFRS principles, which in turn have other critical issues.

Conclusions

We think the market should use a much more comprehensive set of data rather than focusing mainly on S2 information to build a more stable and coherent framework in order to determine a fundamental economic value of equity capital of an insurance company. Ultimately – in line with the principle that the value of equity depends on the NPV of all the resources pertaining to shareholders in the future, we believe market participants need to form a view of dividend paying capacity of insurers based on all bottle necks that exist: regulatory capital (in and outside the EU), rating capital (where relevant to the business model), IFRS earnings (often driver of dividend policies), local GAAP (sometimes a bottle neck to intragroup dividend remittances), cash remittances from the group subsidiaries, holding liquidity, funding and leverage capacity where debt utilisation rates are sub-optimal (too high or too low). But, above all, we think it is paramount to "follow the business". Strategic and competitive analysis, margin analysis, genuine growth, capex needs, cost analysis (structure vs distribution) are just some examples of fundamental drivers of value that sometimes are not always sufficiently dissected in the external valuation by financial markets' participants – and that are difficult to analyse based on public S2 disclosure alone.

Figure 21: Bottle necks of dividend paying capacity of an insurance company



We believe that S2 data are valuable and provide insights, "it represents a huge improvement over Solvency I although it has not fully achieved the goals it aspired to. There are acknowledged shortfalls and imperfections where adjustments to Solvency II are likely. There remain other concerns around pro-cyclicality, and the appropriateness of market consistency is still open to criticism"[15], while SFCRs have provided useful disclosure to allow for more meaningful conversations with management around capital and capital allocation[16]. It is important, however, to be aware of the critical issues impacting the use of S2 data for valuation purposes and in our view a framework built with the basic aim to protect the policyholder shouldn't be used as a standalone tool for equity valuations.

[15] Rae D., Barrett A., Brooks D., Chotai M., Pelkiewicz A., Wang C., *A Review of Solvency II – Has It Met Its Objectives?*, Institute and Faculty of Actuaries, May 2017.

[16] Rousseau L., *Technical Newsletter #43* (www.scor.com/sites/default/files/tnl-solvency_ii.pdf), SCOR, 2018.

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Bank Valuation Using Multiples in US and Europe: An Historical Perspective

Mario Massari* - Christopher Difonzo** - Gianfranco Gianfrate*** - Laura Zanetti****

We investigate the performance of relative valuation for US and European banks over the period 1990-2017. While the literature on the use of multiples is well developed, the relative valuation of financial institutions has received scant attention. We study the distribution and the main properties of each multiple's valuation errors, assessing which multiples work best and should be preferred when valuing banks. Our results show that on average high levels of accuracy are achieved by two years forward P/E. Moreover, diluted earnings not including extraordinary items should be preferred when computing trailing earnings multiples and, interestingly, P/BV consistently outperforms P/TBV. Dividends' multiples are not among the best performers, anyway, it is preferable to consider only common dividends when computing them. Most of the times P/Deposits and P/Revenues deliver poor performances, therefore it is advisable not to use them as main valuation approach.

1. Introduction

The performance of multiples with respect to equity valuation of non-financial companies has been extensively debated in financial and accounting literature (Liu et al., 2002; Liu et al., 2007; Nissim, 2013). However, research and evidence are limited concerning the equity valuation of banks. In fact, the relative valuation approach (also referred to as "market approach") may represent the simplest way to value a bank: the approach specifies the value of the bank as a function of selected fundamentals and the average price of peer banks (Forte et al., 2018; Nissim, 2013).

This work analyzes the accuracy of the market approach for US and European bank valuation. We first measure the performance 08 multiples based on value drivers such as the book value of equity, the tangible book value of equity, revenue, trailing earnings, forward earnings, common dividends, total dividends, bank deposits, and customer deposits. Following Liu et al. (2002), we measure the accuracy of multiples by comparing the "theoretical" valuation of banks obtained using multiples to the actual prices: multiples that produce the lowest errors – meaning the difference between theoretical prices and actual prices – are considered to be most accurate.

The results of our analysis show that the accuracy of multiples for US entities is significantly higher when European metrics are used, whereas small retail and investment banks present more of a valuation challenge than large retail banks. Forward Price/Equity (P/E) multiples outperform historical multiples, and multiples based on two-year-ahead forecasts (not just one-year-ahead) are more accurate. Despite the usual practitioner assumptions, Price/Tangible Book Value (P/TBV) is not found to be more meaningful and precise than Price/Book Value (P/BV). The P/BV is preferred. This study also reveals the weak relationship between value and the amount of preferred dividends: P/Common Dividends is a more precise tool than P/Total Dividends. Finally, P/Bank Deposits appears to be an accurate value driver when valuing investment banks, whereas P/Customer Deposits is preferred when addressing commercial banks.

The structure of this paper is as follows. A description of relative valuation (introducing all of the multiples analyzed) is presented in Section 2, while Section 3 summarizes the major contributions published in literature. Section 4 describes the data and the methodology adopted to assess the performance and accuracy of multiples and presents all of the results for each analysis subsample. The impact of the financial crisis and the introduction of the Euro on relative valuation precision are studied. Additionally, regression and correlation analyses investigate whether significant positive and negative errors, corresponding to undervalued and overvalued banks, reflect subsequent price reactions.

2. Relative valuation

The use of multiples to perform company valuation has been showing an increasingly positive trend, following the development of financial markets and corporate finance deals during the last decades. Moreover,

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great supporters of complex valuation techniques frequently recall the use of multiples when estimating terminal values or checking for plausibility of their results (Bhojraj & Lee, 2002).

The logic behind relative valuation is grounded on the assumption that market prices are largely efficient, that, on average, fundamentals are correctly priced in, and that the law of one price holds. The basic principle governing relative valuation (i.e., similar assets, and so similar firms, should trade at similar levels) fully relies on this set of assumptions. Market prices thus need to be close to the true intrinsic value of firms.

The following list of multiples is the collection of the ones selected to run this empirical analysis, which correspond to the ones mostly used and considered by analysts and practitioners when running valuation for banks.

Price/Book Value of Equity (P/BV)

The ratio between the market capitalization of the firm and the book value of equity is widely used for capital-intensive businesses, whereas it is less appropriate for sectors where the main driver of price performances is future growth (e.g., technology). It is considered one of the most suitable multiples for financial institutions since it captures the regulatory attention on solvency, capital requirements and equity maintenance.

Price/Tangible Book Value of Equity (P/TBV)

This multiple is a variation of the previous one and deducts the value of all the intangible assets from the equity. Many practitioners prefer to use this multiple over the simple P/BV in order to obtain a more conservative figure, which uses a liquid representation of book value eliminating the potential bias deriving from the accounting of illiquid intangible assets. The intuition is that, in case of default, the value of intangible assets may easily collapse to zero, so it is advisable to use a multiple that eliminates their interferences. Moreover, it recalls the regulatory capital composition of the CET1 Capital according to Basel III, which indeed deducts goodwill and other intangibles.

Price/Revenues (P/Revenues)

Market capitalization divided by revenues is one of the less used and most criticized multiple. Firstly, because revenues should be compared with an asset-side measure (e.g., enterprise value). Secondly, comparing banks using only this multiple may lead to misjudgements because the cost structure and the riskiness of the underlying assets, which generated those revenues, are not considered.

Price/Deposits (P/Deposits)

Market capitalization is divided by the deposits, which is the core driver for the vast majority of commercial banks. This multiple used to be popular in the past but nowadays banks are more diversified and their revenues and profitability depend more and more on fees-generating activities rather than on the sole interest income. This explains why this multiple is now less used, but it is still helpful. In fact, given that deposits should be rather uniform among retail banks, they are a good candidate as explicative operating multiple.

When considering deposits, these could be measured in two different ways: the first one considers customer deposits only (i.e., demand, savings and time deposits held on account for individuals and corporations), the other one includes also bank deposits (i.e., the deposits held on account for other banks). The latter thus considers not only collections from customers, but also the involvement in the interbank market. This broad measure is the one used in this work.

Price/Dividends (P/Dividends)

Share price is divided by dividends per share, or, alternatively, market capitalization is divided by the entire amount of dividends. This is another operating multiple typically used for banks because of the importance of dividends for these institutions. In fact, dividends are the unique meaningful cash flow in the banking sector, as also highlighted when discussing about intrinsic valuation. However, this multiple could be applied to firms operating in any sector, but it would be meaningless in many circumstances.

Many companies, differently from banks, do not distribute dividends so frequently because they prefer to implement alternative shareholders' remuneration practices (e.g., shares buy-back programs) or they simply prefer to retain earnings to finance investment opportunities using internal sources.

When computing dividends multiples, it is important to consider that dividends distributions may occur more than once in a year and so all the relevant flows have to be summed up to obtain a yearly value. Moreover, this multiple can be built in two different ways, depending on the choice made for dividends. Considering that total dividends is the sum of common dividends, paid on common shares, and preferred dividends, paid on preferred shares, the multiple can be computed using total dividends (P/Total Dividends) or common dividends only (P/Common Dividends) as the denominator. The distinction wants to catch potential connections between preferred stocks and value. The use of common dividends only is generally preferred because they should better reflect value with respect to preferred dividends, which are more stable and less dependent on the actual level of profitability achieved in a given year. However, for the sake of this empirical study, both will be computed.

The last important consideration is related to outliers, which in this case can strongly affect the multiple. If dividends are particularly low because of a lack of financial resources or as a result of a strategic choice, the average multiple may reach extremely high values, negatively affecting the quality of the valuation performed.

Price/Earnings (P/E)

The last multiple analysed is considered "the king" of relative valuation, in particular for banks. It is computed as the ratio between the share price and earnings per share (EPS) or alternatively as market capitalization over total earnings. The multiple can be built in different ways, depending on the methodology used to select earnings.

Firstly, the choice can be made distinguishing between trailing and forward earnings. If historical values, i.e., the earnings of the last twelve months (LTM earnings) are used, it is classified as a trailing – or LTM. Alternatively, if analysts' forecasts for earnings are used, it is classified as a forward multiple. Forecasts can be computed on a one year, two years or more years basis, but best practices generally use one or two years forecasts, to avoid a strong dependence on estimates based on unobservable and unpredictable figures. Nevertheless, Yee (2004) demonstrated that from a theoretical standpoint the use of more forward earnings represents an effective and important attribute in order to obtain more accurate results when performing valuation (i.e., the more forward, the more accurate).

The second element affecting EPS calculation is dilution. The resulting multiples are the Basic P/E, if EPS are computed considering only outstanding common shares or instead the Diluted P/E if diluted common shares are considered. Diluted common shares include the effects generated by the hypothetical exercise of all the outstanding convertible securities (e.g., convertible bonds, stock options, warrants), which causes an increase in the number of outstanding shares. This assumed increase pushes EPS down (diluted EPS are lower than basic EPS, if there are convertible security outstanding) and, consequently, the resulting multiple is higher.

The last point about earnings calculation is whether to include non-recurring items. The rationale behind the exclusion of these items is that unusual and extraordinary gains or losses should not affect valuation, since these will not constantly take place in the future. In this way, earnings excluding extraordinary items communicate better the actual profitability of a company without suffering from any interference directed by one-offs.

The combination of all these aspects and considerations gives rise to the identification of six different P/E multiples, which will be inspected in this work. They are:

– P / 1 Year Forward Earnings
– P / 2 Years Forward Earnings
– P / LTM Diluted Earnings, considering extraordinary items
– P / LTM Diluted Earnings, excluding extraordinary items
– P / LTM Basic Earnings, considering extraordinary items
– P / LTM Basic Earnings, excluding extraordinary items

Nonetheless, P/E has an important drawback that can limit its applicability. In case of negative earnings, the multiple becomes completely meaningless because of its negative value. In order to avoid any issue, the set of comparables must be built accordingly. Moreover, the presence of outliers should be accurately monitored in case of very low earnings that can generate an abnormal increase in the multiple. In particular, Dermine (2010) outlines that the use of the P/E is biased when banks report large provisions for credit losses (a problem that, recently, has been affecting the banking system of many countries, such as Italy) implying lower earnings. This causes large volatility in the multiple and drives bias.

3. Literature review

While the extensive use of multiples among both practitioners and academicians has progressively grown, theory and empirical research have also demonstrated some advancements, but still limited guidance is available to assess relative valuation metrics performance.

Essentially, some practitioners consider the use of multiples as an art form[1] rather than a science. Therefore, they suggest that the practice should be left only to industry professionals. Notwithstanding, the importance of multiples in valuation methods and their efficacy in supporting investment decisions have attracted many researchers to this field. Both standard literature and empirical studies on multiples have experienced notable advances over the past decades, becoming a debated topic among academicians.

Methodologies and findings from Nissim (2002 & 2011) and Cooper (2008) are particularly relevant for the development of this empirical study. Additionally, contributions to the literature coming from other authors provided an important theoretical support and many relevant intuitions.

Nissim (2011) analysed the accuracy of relative valuation for U.S. insurance companies. From March 1990 to January 2011, he monthly analysed a sample

[1] Bhojraj (2003) noted that the level of subjectivity required in the application of multiples, is inconsistent with a scientific standpoint. In particular, the selection process of comparable firms tends to rely strongly on individual analyst's expertise.

of 372 different firms, demonstrating that valuation performs better when using earnings forecasts (i.e., forward multiples) rather than reported earnings (i.e., trailing multiples). The same result will come from the analysis here performed. His study also proved that book value multiples perform robustly, in particular if the price-to-book ratio is conditioned to ROE. Moreover, Nissim observed other two relevant aspects, which are less marked in the results from the analysis here performed, but still evident. He compared the performance of Basic P/E and Diluted P/E, observing that the latter has higher predictive properties. He also showed that valuation accuracy substantially improves when using income before special items instead of reported income.

In a previous work Liu, Nissim & Thomas (2002) carried out a comprehensive analysis of multiples' precision in the U.S. between 1982 and 1999, drawing up a ranking of the better performing multiples, which holds true for almost every sector analysed. Multiples were ranked as follows: forward earnings measures as the best ones, then historical earnings measures as a valid second best option, cash flows measures and book value measures perform equally ranking as third, sales measures as the worst ones. These results are in line with the ones here obtained.

Cooper (2008) aimed at finding the optimal number of comparable firms to use when computing out-of-sample multiples. The results of his analysis highlighted that the use of about five comparables is optimal when some requirements are met (i.e., comparables operate in the same industry, their expected growth rates are close to the one of the target firm and their average growth rate stays within 1% of the target firm's growth rate). Cooper's work is extremely useful here for the statistical tools implemented, which will be introduced later in the empirical section, more than for the results achieved.

Cheng & McNamara (2000) inspected valuation accuracy when using historical P/E multiples, P/BV multiples and a combination of the two using equal weights. The analysis was performed for the U.S. equity market, firstly considered as an aggregate and then split depending on SIC codes[2]. They found that the equally weighted combination of P/E and P/BV performed better than both multiples alone, underlying that both earnings and book values are significant value drivers.

Alford (1992) tested the effects of the choice of comparable firms on the precision of valuation estimates when using earnings multiples. In particular, he focused on the use of industry membership and proxies for growth and risk for the selection of comparables. Results showed that valuation accuracy increases when the level of detail for the industry definition used to identify comparables is not too specific (i.e., three-digit SIC codes). Differently, Bhojraj & Lee (2002) implemented a matching mechanism to identify comparable firms based on the use of economic variables, rather than industry membership. The analysis here performed combines the different intuitions coming from these two studies: only banks will be considered, but the sample will be then subdivided depending on balance sheet figures determining size (large or small) and business model (commercial or investment bank).

Minjina (2009) implemented the same analysis done by Nissim, but he did not focus on the same market and on a unique sector. Indeed, his analysis embraced all the companies listed in the Bucharest Stock Exchange from January 2003 to June 2008, but excluded the financial sector. Results underlined that Price/Cash Flows (P/CF) and Enterprise Value/EBITDA (EV/EBITDA) are the first and second best multiples to use when valuing Romanian companies, whereas Price/Sales appeared to be the least reliable. As already mentioned, these multiples are not significant and somehow meaningless for banks, which also explains why the financial sector was excluded to perform this analysis. Another relevant outcome of Minjina's study was the observation of a lower performance accuracy for Romanian listed companies, if compared with companies from more developed countries. The lower efficiency of Romanian capital markets and the smaller size of Romanian companies are considered the main determinants of this finding. The same difference in accuracy will be evident later, when comparing results for multiples' accuracy between American and European banks.

Forte et al. (2018) investigates the role of relative valuation in the banking industry by evaluating the accuracy of a group of industry specific multiples. The results highlight that stock market multiples are best suited for US institutions, and that a two-year-forward P/E is the most precise metric. Contrary to practitioner beliefs, P/Tangible Book Value is less meaningful than P/BV. Multiples accuracy declines in case of small commercial banks relative to large commercial banks and investment bank relative to retail banks pointing out that for small retail bank and investment bank equity valuation using multiples becomes a more challenging exercise. Additionally, error distributions are exploited to assess whether large po-

[2] The Standard Industrial Classification (SIC) is a system for classifying industries by a four-digit code. SIC codes can be grouped into progressively broader industry classifications: industry group (the first three digits), major group (the first two digits) and division (encompassing a range of SIC codes).

sitive errors lead to systematic one-year positive price performances and whether negative errors lead to negative price changes.

4. Performance and accuracy of multiples

This section discusses about the main findings of the empirical research conducted to analyse the effectiveness of multiples and to understand if there is one multiple outperforming the others, which should be therefore considered the most reliable to perform banks valuation. Detailed analyses on valuation accuracy and on the distribution of valuation errors are presented. Furthermore, the effects on the performance of relative valuation driven by the introduction of the Euro and of the 2007/2008 financial turmoil are analysed. In the last part, a summary ranking of the best multiples to be used in each subgroup of banks is proposed.

4.1. Data

The timespan considered in our empirical analysis starts in January 1990 and terminates in April 2018. The dataset comprises all the banks currently listed, but also banks that have been listed during the period analysed. Delisting mostly derives from M&A activity or bankruptcy, more rarely it represents a strategic choice taken by the management. The final dataset is composed of 1,118 banks, of which 181 located in the Eurozone, while 937 are American. When building a database for comparables, there is always a "bias versus variability" trade-off to consider. In this case, variability is minimized, but the bias deriving from big differences among comparables may be relevant. The different techniques, which have been adopted to limit this effect and increase homogeneity, are showed later.

The analysis required a wide range of financial data, which have been collected from different data providers and then merged into a unique dataset. The list of these data providers and the corresponding data collected follows.

– Wharton Research Data Services – Compustat

This database provides all the historical Balance Sheet and Income Statement figures, along with other accounting measures (e.g., the number of shares outstanding). Data from 1990 until 2017 have been collected, using two different queries. The "Bank – Daily" query provides data for North America banks only, so data for banks in the United States were easily collected filtering only for the country. To collect data for the Eurozone, the "Compustat Global – Fundamental Annual" query was used. However, this dataset covers all the industries globally. Data were therefore filtered according to the GICS[3] codes, including only the entire Industry Group 4010 (Banks) and the Industry 402030 (Capital Markets), and according to the country, including only the ones within the Eurozone (Table 1). Furthermore, it is important to underline that these two queries do not provide the same information. In particular, the one used for the Eurozone does not provide data on diluted earnings, so that two multiples (i.e., P/LTM Diluted Earnings, considering extraordinary items and excluding extraordinary items) cannot be computed for these banks.

– Institutional Brokers' Estimate System (I/B/E/S)

This database, accessed via Thomson Reuters Datastream, provides all the analysts' forecasts, which are fundamental to compute forward multiples. Moreover, the measure of volatility of forecasts (i.e., the standard deviation of two years forward earnings) and the number of analysts covering each bank were collected from I/B/E/S.

– Bloomberg

Weekly prices have been collected from Bloomberg and then a monthly value has been obtained computing the median of the corresponding weekly observations. However, to compute multiples, only one price for each year is required and the April one has been selected. This choice is consistent with practice and follows the procedure implemented from Nissim in his study on relative valuation performance for the insurance sector. Market prices are selected four months after the fiscal year end to ensure that all year-end information are publicly available and reflected in prices (Schreiner, 2007). Moreover, in April, I/B/E/S updates and publishes summary forecasts, maximising also consistency between prices and future estimates.

Once that all data have been collected, in order to increase comparability and to reduce bias, banks have been divided in subgroups, maintaining the American and the European sample separated.

The first differentiation is related to the business model, distinguishing between Investment and Commercial Banks. Following the example of Beltratti and Stulz (2009), a summary ratio is computed for each bank as the median of the available ratios of Customer Loans over Total Assets, between 1990 and 2017. A threshold is set at 40%. Banks with a summary ratio exceeding the threshold are labelled as Commercial Banks, since the ratio signals that the business model is particularly focused on lending money to clients, more than on offering advisory services. Loans to banks are not included when computing the ratio to eliminate the effects of banks participating to the in-

[3] The Global Industry Classification Standard (CIGS) is an industry taxonomy developed by MSCI and Standard & Poor's used to categorise all major public companies. It consists of 11 sectors, 24 industry groups, 68 industries and 157 sub-industries.

terbank market, which may be the case also for pure Investment Banks.

The second distinction, which applies to Commercial Banks only, refers to size. Differentiating for size can make significant contributions since size has strong implications for the value of different banks (Alford, 1992). Large banks are generally less risky because their international scope gives them better access to customers and deposits, enhancing recurring revenues (Schreiner, 2007). Moreover, they can be perceived as "too big to fail", they can have more market power and enjoy economies of scale or scope and they can benefit from increased diversification, while small banks generally operate as niche players on a regional basis. Compared to small banks, large banks also enjoy greater financial flexibility having better access to capital market funds (Calomiris & Nissim, 2007). However, small banks can have higher strategic flexibility and growth potential, under the precondition of financial health and financing power. To fulfil a distinction based on size, for every bank, the median of Total Assets during the analysed years is computed and it is then compared with the median of the entire dataset. Banks exceeding this median are labelled as Large, the others as Small (Table 1).

Table 1 – Summary of Classification of Banks

		Investment Banks	Large Comm. Banks	Small Comm. Banks	Total
Number of Banks	U.S.	32	452	453	937
	Eurozone	31	75	75	181

4.2. Methodology

Relative valuation can be performed on the basis of out-of-sample multiples, so excluding the institution being valued from the group of banks considered for the computation of the multiple in each year. This methodology is considered the most reliable, since it minimises potential biases. Furthermore, multiples are computed using the harmonic mean: this way, the effects of outliers and of right asymmetry are strongly reduced (Nissim, 2011). A "theoretical" price is then computed multiplying the out-of-sample mean multiple by the corresponding value driver. If market prices are efficient, a theoretical price close to the actual market price suggests that a specific multiple performs well when running relative valuation. Therefore, to assess the performance of different multiples, for each bank in each year, the theoretical price is compared with the actual market price. It allows to calculate valuation errors (as percentage errors), as the difference between the theoretical price and the market price, divided by the actual price. According to Dittmann and Maug (2008), percentage errors, even though they are more basic than log errors, generate the least biased error when using the harmonic mean to aggregate the multiples of comparables. However, percentage errors penalise overvaluation more than undervaluation. This is why undervaluation in excess of −100% is impossible, while overvaluation is not limited and can easily go over +100%.

Setting x as the firm under analysis and t as the selected year, errors are computed as follows:

$$Error\ (x;t) =$$
$$= \frac{Multiple\ (all\ banks\ except\ x;t) * Value\ Driver\ (x;t) - Market\ Price\ (x;t)}{Market\ Price\ (x;t)}$$

Furthermore, in order to evaluate the performance of multiples, bias, mean absolute deviation (MAD) and mean-squared error (MSE) of the errors are computed, replicating Cooper and Cordeiro (2008) analysis. These measures are calculated according to the following formulas, where T is the total sum of observations (every bank for every year) and N is the total number of banks in each subsample:

$$Bias = \frac{1}{T}\sum_{t=1990}^{2017}\sum_{x=1}^{N} Error\ (x;t)$$

$$MAD = \frac{1}{T}\sum_{t=1990}^{2017}\sum_{x=1}^{N} |Error\ (x;t)|$$

$$MSE = \frac{1}{T}\sum_{t=1990}^{2017}\sum_{x=1}^{N} Error\ (x;t)^2$$

It is relevant to underline that MSE has been computed exploiting 95% Winsorization[4]. It is a common practice, which reduces the effects of large outliers that, once squared, can become too big and compromise results. Graphs are built using Normal Kernel Density[5] estimation, choosing a suitable bandwidth[6] and imposing the maximum level (1,000) of number of points at which evaluate the density function (or grid points) in order to do not lose the informative power of data. In order to lighten the chart, the bottom axis endpoint is set at 4.5 and not all multiples are included.

In order to evaluate multiples' performances, valuation accuracy is inspected following Nissim's procedure. The percentage of observations with estimated error in absolute value within 10%, 25%, 50%, 75% and 90% of price are computed. These measures are useful to understand which multiple is more accurate and reduces the size of errors.

4.3. Results

After having explained all the methodologies implemented to perform the empirical analysis, this section will focus on the main findings deriving from the analysis of data. A general overview presenting common elements among all the subsamples is firstly proposed. Next, banks in each subgroup are considered, mostly focusing on the distribution of errors. Percentage errors that are at most 25% of the price are then examined on a yearly basis, to observe the evolution of multiples' performance through the entire period under scrutiny. In addition, the effects on relative valuation and on multiples' efficiency caused by the introduction of the Euro in 2001 and by the 2007/2008 financial turmoil will be analysed. Finally, all the results will be summarised providing a ranking, which suggests the multiples to prefer and the ones to avoid for each subgroup of banks.

4.3.1. General Overview

There are some results that are common among all the subgroups analysed, so they are summarised here in order to avoid redundancy.

– The use of multiples is much more precise for American banks than for European ones, as highlighted by valuation accuracy and measures of performance. This can be easily explained by the negative effects deriving from wide heterogeneity among European peers. In fact, the Eurozone includes countries with strong differences, namely in culture, financial education, regulation and stock markets. Moreover, the higher performance of multiples can be related to the fact that market-oriented financial system, like the American one, show a stronger demand for value relevant accounting information and to the higher capital markets efficiency, which distinguish the U.S. from

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[4] Winsorization is a statistical technique that substitutes values exceeding a certain threshold (in this case, the 95th percentile) with the threshold itself. It is preferred to simple trimming because thanks to Winsorization no observation is lost and the original size of the sample is always maintained (Kokic & Bell, 1994).

[5] Kernel Density estimation is a non-parametric way to estimate the probability density of a random variable. Heuristically, it is an adjusted histogram in which "boxes" are replaced by smooth "bumps" (Silverman, 1986). Smoothing is done using a Kernel weighting function that puts less weight on observations that are further from the point being evaluated. The Normal Kernel weighting function is computed according to the following formula:

$$\frac{1}{\sqrt{2\pi}}\exp\left(-\frac{1}{2}u^2\right),$$

where u is the argument of the Kernel function.

[6] The bandwidth controls the smoothness of the density estimate: the larger the bandwidth the smoother the estimate. Although there is no general rule for the appropriate choice of the bandwidth, Silverman (1986) makes a case for undersmoothing by choosing a somewhat small bandwidth, since it is easier for the eye to smooth than it is to unsmooth. The same approach has been here used in order to give a clear representation.

Continental Europe, as also highlighted by Herrmann and Richter (2003).

– Large Commercial Banks show the stronger multiples' precision in the U.S., with marked differences with the other subsamples. In Europe, these differences in predictability are less evident between Large Commercial Banks and Investment Banks, apart from P/BV and P/TBV multiples that clearly show higher accuracy for Investment Banks. Conversely, multiples of Small Commercial Banks show the lowest level of accuracy in Europe, while the worst performers in the U.S. are Investment Banks, suggesting that these institutions should be valued with more caution, in particular when selecting comparables.

– In every subsample, forward P/Es are markedly better indicators of any other multiple. They consistently show the highest level of accuracy and performance. This result was actually expected, since prices should reflect future expectations. For instance, compared to reported earnings, analysts' earnings forecasts provide a more direct estimate of future profitability and, since they reflect a larger information set, they are likely to be more accurate (Nissim, 2011). Moreover, I/B/E/S forecasts obviously exclude impacts of extraordinary events, providing a sustainable proxy for permanent core earnings that should therefore persist in the future.

– In line with what theoretically hypothesized by Yee (2004), multiples based on two years forward forecasts of earnings are generally more precise than the ones using one year forecasts. The only exception is the European Small Commercial Banks subsample, where the latter delivers slightly better results. Considering historical P/Es, in Europe the one excluding extraordinary items appears to perform slightly better, but there are no marked differences to take a strong position. Conversely, in the U.S., this difference is more evident, suggesting the use of diluted earnings excluding extraordinary items, in fact this choice should reduce the volatility of book value and mitigate potential accounting distortions.

– Among practitioners, it is a common practice to prefer P/TBV to P/BV, since the tangible book value, which is a more liquid representation of book value, is considered less biased and more accurate for the banking sector. Interestingly, the analysis here performed evidences opposite results with P/BV always showing smaller valuation errors than P/TBV. American Investment Banks are the unique exception, where at 10% accurateness P/TBV gets the 7.0% of banks while P/BV the 6.2%. However, if the precision bound is relaxed to higher value, P/BV always outperforms P/TBV. Moreover, the accuracy of book value multiples is particularly low for Large and Small Commercial Banks in Europe, indeed at 10% accurateness they get approximately 3.0% of banks. Looking at these errors more in-depth, they are particularly high during crises and may have been driven by a large number of outliers, for instance banks consistently trading below book value in countries such as Cyprus, Greece, Italy and Spain. High levels of heterogeneity in Europe, boosted by different governments' responses to the financial crisis, suggest to attentively selecting comparables when using these multiples that can anyway deliver sufficient accuracy, as results for American banks demonstrate.

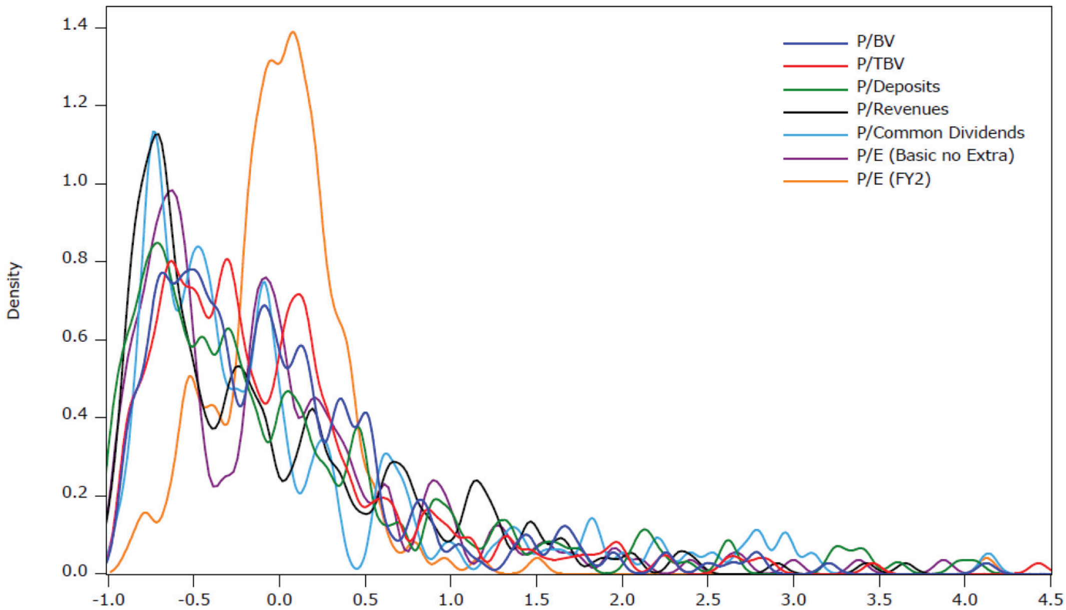
– Considering the two alternative ways of computing multiples based on dividends, results show that the use of common dividends should be preferred, in particular in Europe. While, in the U.S., differences in performances are less evident. For these reasons, there is not a real connection between preferred dividends and value, in fact, in some extend they can be compared to extraordinary items and, therefore, they should be excluded when valuing a company. Moreover, the analysis of multiples' performances through time shows that P/Common Dividends always follows an individual path, delivering poor accuracy but being enough stable. It suggests that dividends are not the best fundamental to use and that they can potentially be misleading.

– Both multiples based on deposits and revenues do not show interesting levels of accuracy, in particular in Europe, where they are characterised by high asymmetry. However, performances of these multiples when valuing American Large Commercial Banks is quite satisfactory, in particular in recent years. Nevertheless, it has to be considered that they are consistently overperformed by multiples based on other value drivers. On the one side, the role of deposits within banks has become less crucial in recent years since their business model is shifting towards the offering of many different services disentangled from deposits collection. On the other side, revenues can be strongly misleading since they should be compared with asset-side measures and the level of risk underlying the activities generating these revenues in not considered.

4.3.1. European Investment Banks

Compared to the other European subgroups and considering the lower number of observations, performance of relative valuation for European Investment Banks is quite satisfactory. In general, the distribution of errors (Graph 1) appears noisy and asymmetric, apart from P/E (FY2). In fact, forward multiples are the ones better performing in this subsample and should always be preferred to trailing P/Es, which are anyway an acceptable second best option. Valuation accuracy for P/E (FY2) reaches 27.9% at a 10% level, while bias, MAD and MSE are very limited. Moreover, P/BV and P/TBV perform particularly well if compared with the other European banks and show a low MSE. Conversely, P/Revenues and P/Deposits are not among the best performers, but still they work better than for the other European Banks (in particular Small Commercial Banks). Multiples based on dividends show the higher levels of bias, MAD and MSE, signalling high volatility and the presence of many outliers, as it is also evidenced by the distribution of errors.

Graph 1 – Distribution of errors for European Investment Banks



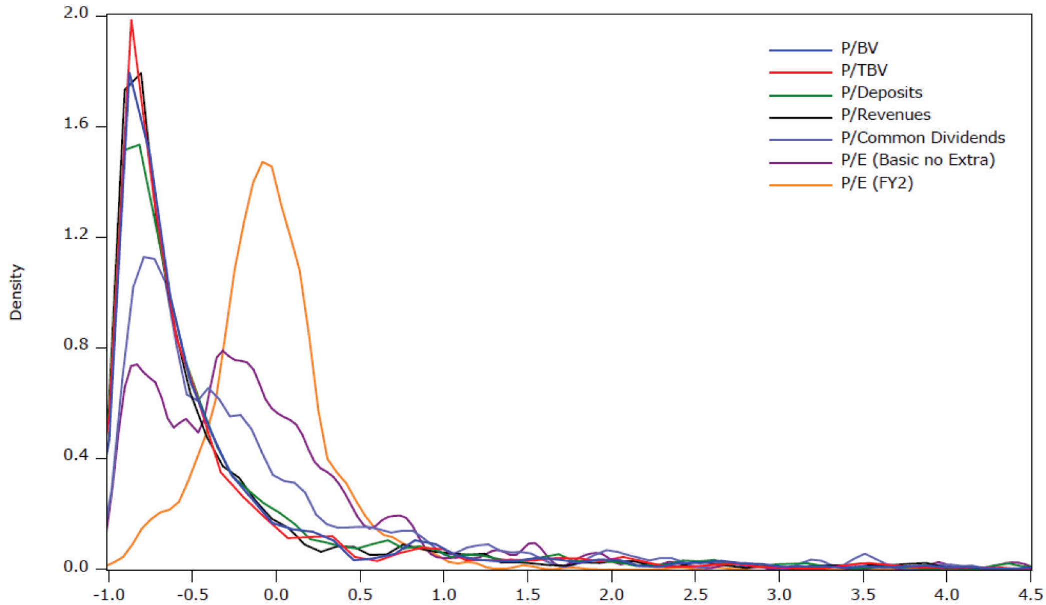
Note: Normal Kernel Density (bandwidth=0.05).

The high level of heterogeneity in Europe has been highlighted as a potential driver of inaccuracy. However, this case is characterised by sufficient homogeneity (due to the restrictive selection process resulting into a low number of banks included in this group) that plays a positive role: errors are overall better distributed than in the other European subsamples.

4.3.2. European Large and Small Commercial Banks

Earnings multiples are the most important value driver for European Large Commercial Banks, in particular, at a 10% level, P/E (FY2) can predict the 27.9% of banks' prices, while P/E (Basic no Extra) the 11.1% only. The apparent bell shaped distribution of errors (Graph 2) for P/E (FY2) highlights the presence of few outliers, being quite gratifying.

Graph 2 – Distribution of errors for European Large Commercial Banks

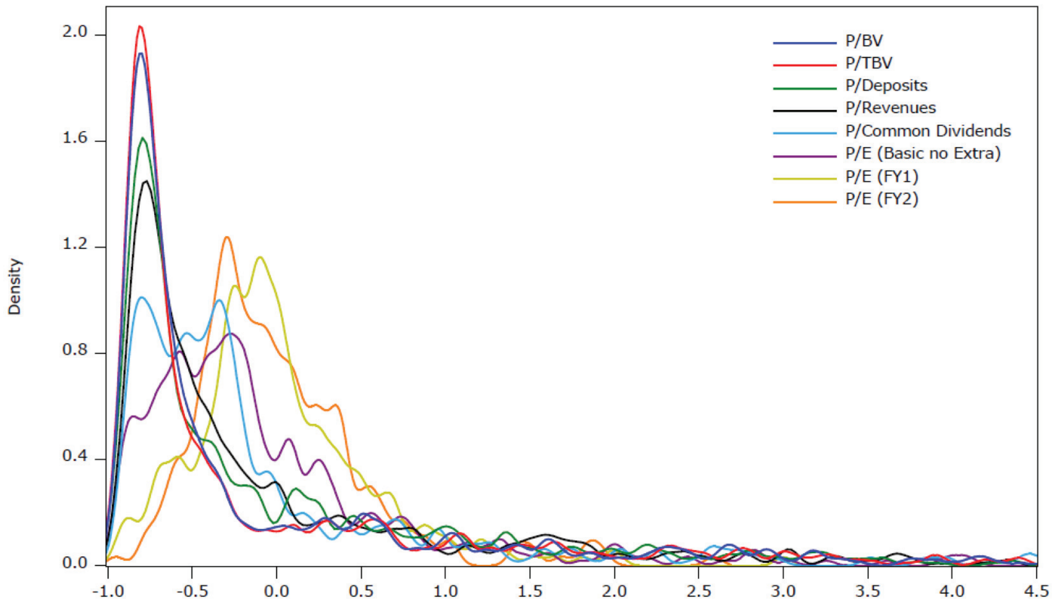


Note: Normal Kernel Density (bandwidth=0.05).

However, the distribution of errors for the other multiples brings to opposite considerations. Apart from P/Common Dividends, which shows discrete accuracy and performance indicators, multiples based on BV, TBV, Deposits and Revenues are affected by a strong left asymmetry as highlighted by their distribution peaked at very negative values. Indeed, the 75th percentile is negative for all these multiples, indicating that more than the 75% of the observations are below zero. Additionally, the fact that bias of these multiples registers the highest positive values signals that there are few, but very big, positive outliers. Indeed, MAD is three times bigger than bias and MSE registers the highest values. Overall, apart from earnings and, in particular, forward ones, the other value drivers do not deliver positive results and they work better for European Investment Banks.

Focusing on European Small Commercial Banks, considerations are even worse, as a first look at the distribution of errors (Graph 3) communicates.

Graph 3 – Distribution of errors for European Small Commercial Banks



Note: Normal Kernel Density (bandwidth=0.05).

This is the unique subsample where P/E (FY1) delivers the highest accuracy: at a 10% level it predicts 20.2% of prices against 17.1% of P/E (FY2), but looking at bias, MAD and MSE, values are lower for the latter. The distribution of errors for both forward earnings multiples is quite similar. The one of P/E (FY1), on the one side, seems to show higher density for values closer to zero, on the other side, big negative errors appear more frequent. Furthermore, the less reliable multiples are the ones based on BV and TBV, registering the highest MSE and very bad accuracy, which is lower than 3.0% at a 10% level. Moreover, the median multiples stand respectively at 0.67x and 0.70x, suggesting high risk of undervaluation. In fact, left asymmetry is extremely evident: the distribution of errors is peaked at very negative values. However, it appears to be lower than the case for large banks, in fact the 75th percentile takes on positive values because of the presence of a higher number of positive observations. Moreover, also large outliers are more frequent, as confirmed by the bumps in the right tails. Errors of P/Common Dividends are better distributed, but still performance and accuracy are quite low.

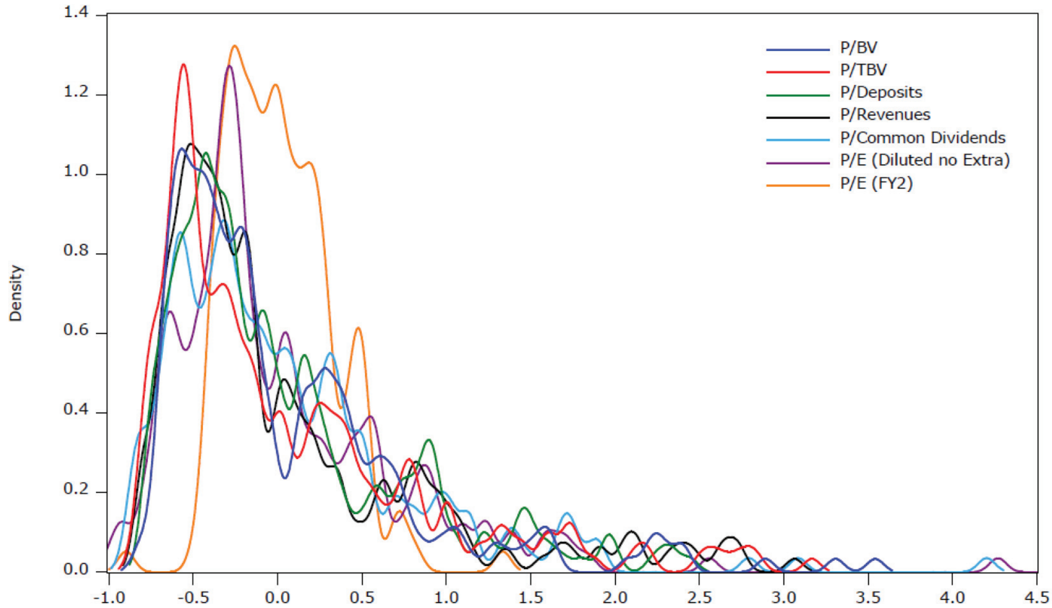
Overall, these results suggest that multiples should be used more as a confirmatory tool than as primary valuation methodology for European Commercial Banks. Unique exception is the use of forward earnings multiples for Large Commercial Banks. While results for Investment Banks are quite acceptable. However, it is important to recall that the selection of comparables can have significant impacts in this case and can potentially deliver stronger results.

To sum up, it is advisable to prefer forward P/E multiples since they deliver more precise values than any other multiple. However, trailing multiples could be considered a second best option when forecasts are not available.

4.3.3. American Investment Banks

Accuracy of forward P/Es is quite satisfactory for American Investment Banks, showing substantially similar results when using FY1 and FY2 earnings (at a 10% level, both predict 23.2% of prices), while MAD and MSE are lower for the latter measure. Apart from P/TBV, which shows low performances and a strong left asymmetry, with high values for MAD, MSE and median (in absolute value), the other multiples are characterised by a relative homogeneous distribution of errors (Graph 4) and similar performances.

Graph 4 – Distribution of errors for American Investment Banks



Note: Normal Kernel Density (bandwidth=0.05).

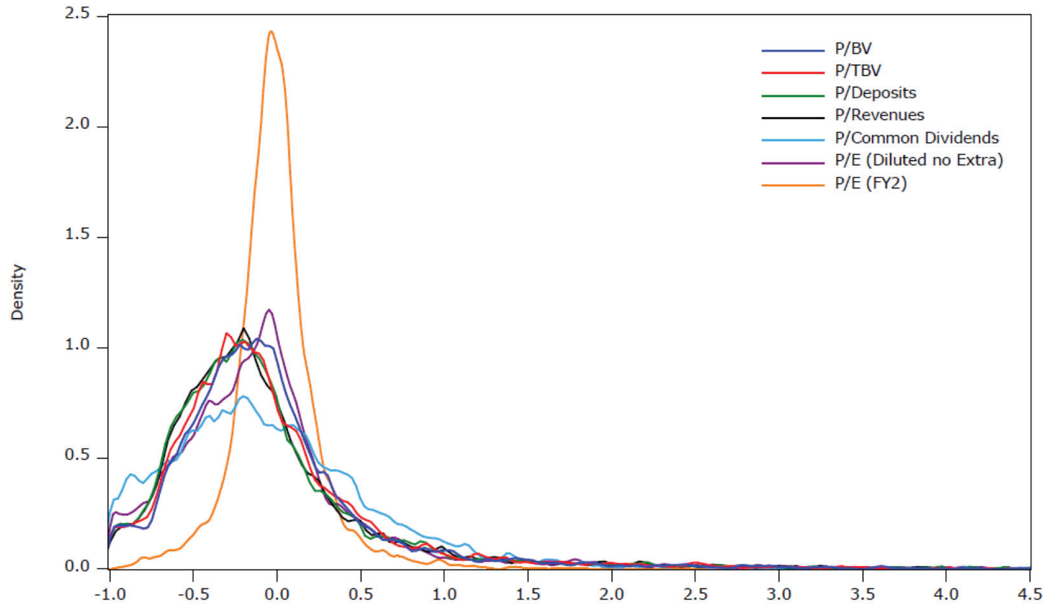
P/Deposits and P/Common Dividends work well registering respectively a 10.3% and 11.5% precision at a 10% level, doing even better than the 10.1% of P/E (Diluted no Extra). These results are anyway worse than the ones registered in the other American subsamples, but they are still better than Europeans' ones. P/TBV and P/Revenues are among the most volatile measures, suggesting their poor reliability and demystifying again the widespread preference of TBV over BV.

Overall, the distribution of errors may result messy and perfromances not convincing if compared to the other American subsamples. However, the analysis of these banks brings to stronger considerations with respect to European ones, enlighting higher suitability of multiples in the United States.

4.3.4. American Large and Small Commercial Banks

The high number of observations (ranging between a maximum of 6,337 for P/BV and a minimum of 5,197 for P/E (FY2)) collected for American Large Commercial Banks, allows to make considerable comments. Multiples for this group of banks show impressive results and, above all, the outstanding performance of P/E (FY2) deserves particular attention. Valuation accuracy stands at 44.6% at a 10% level and it reaches 78.5% and 93.6%, if the accuracy level is relaxed respectively to 25% and 50%. These numbers underline the strong power and the limited size of errors deriving from the use of this multiple. Errors (Graph 5) are overall well distributed and the distribution of P/E (FY2) appears to be bell shaped, really peaked to zero and with relative thin tails. Bias is practically zero, while MAD and MSE are extremely low. These numbers confirm the small magnitude and dispersion of errors when using forward earnings (also results of P/E (FY1) are very similar to these).

Graph 5 – Distribution of errors for American Large Commercial Banks



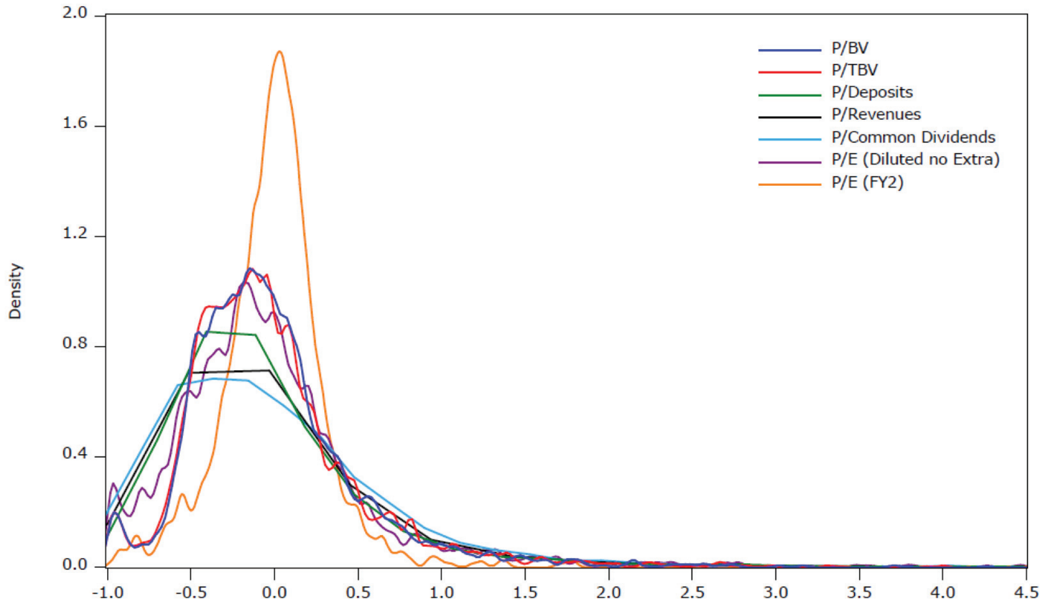
Note: Normal Kernel Density (bandwidth=0.025).

The performance of the other multiples is quite satisfactory too. Bias is extremely low for every multiple, but it benefits from the high number of observations. Trailing P/Es and P/BV can be considered the best alternatives, in fact valuation accuracy at a 10% level stands respectively at 20.6% (diluted earnings excluding extraordinary items) and 18.1%. The remaining multiples, despite the very acceptable levels of accuracy, show higher volatility, as confirmed by MAD and MSE, in particular for multiples built using dividends and deposits. Results confirm, once again, that P/BV should be prefered over P/TBV, that dividends can be easily manipulated, generating distorsions in value, and that it is advisable not to use revenues and deposits as first choice while selecting value drivers.

Despite the lower number of observations for American Small Commercial Banks (in this case, ranging between a maximum of 4,510 for P/BV and a minimum of 1,415 for P/E (FY2)), results are still remarkable. P/E (FY2) produces errors that lie within 10% of price in 33.9% of the cases (which increases to 69.0% and 90.2% relaxing the pricision bound to 25% and 50% respectively). Bias, MAD and MSE are greater than the ones registered in the previous group, but still very limited. Moreover, in this case, the performance of P/E (FY1) is substantially lower than the one of P/E (FY2): bias, MAD and MSE are more than two times bigger and valuation accuracy loses more than 10 percentange points when considering the strictier precision bounds. However, the most impressive results come from P/BV and P/TBV, which deliver the best results among all the subsamples analysed. Indeed, valuation accuracy at a 10% level for these multiples reaches respectively 19.5% and 18.8%, overperforming all the other multiples, including trailing P/Es. Bias is very small and close to the one of P/E (FY2), while MAD and MSE are greater, but among the lowest. Data confirm also the quite stronger performance of P/BV over P/TBV.

The distribution of errors (Graph 6) confirms these findings, with a nice distribution peaked to zero for P/E (FY2) errors. Moreover, P/BV and P/TBV are confirmed as a second best option. Once again dividend multiples are affected by the highest value of MSE, showing high variability and the presence of many outliers. Also accuracy is pretty low, ranking them as the less reliable multiples. Multiples based on revenues and deposits, show acceptable levels of accuracy, but their MSE rank among the highest.

Graph 6 – Distribution of errors for American Small Commercial Banks



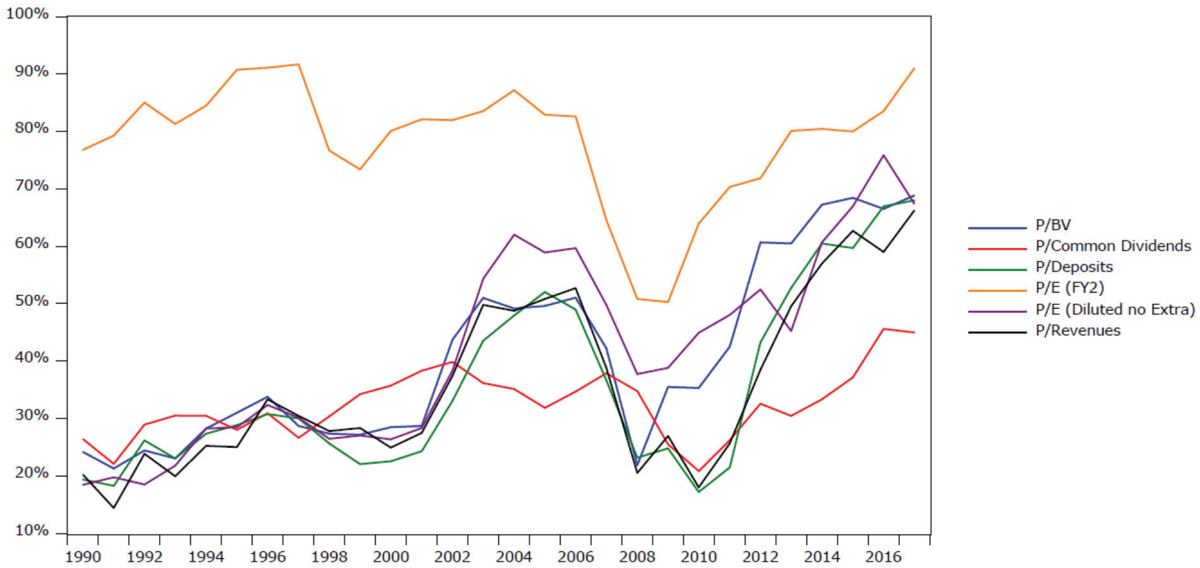
Note: Normal Kernel Density (bandwidth=0.025).

4.3.5. Historical Yearly Performance

This section analyses the evolution of multiples' accuracy on a yearly basis. Errors that lie within 25% of market prices are collected for each subsample in order to observe their yearly evolution. It is important to notice that, because of the split on a yearly basis, the smaller samples, in particular American and European Investment Banks, may show missing data or not reliable figures since very few measures are available in some years (this is why the number of banks under scrutiny is not constant over years because of delisting, new listing o simply availability of data). For these reasons, graphs and results will be commented only for the more relevant subsamples. Moreover, to lighten the chart, not all multiples are included in the graphical respresentation.

The most communicative representation is the one for American Large Commercial Banks (Graph 7). The strong performance of multiples and the high number of observations allow to get important intuitions.

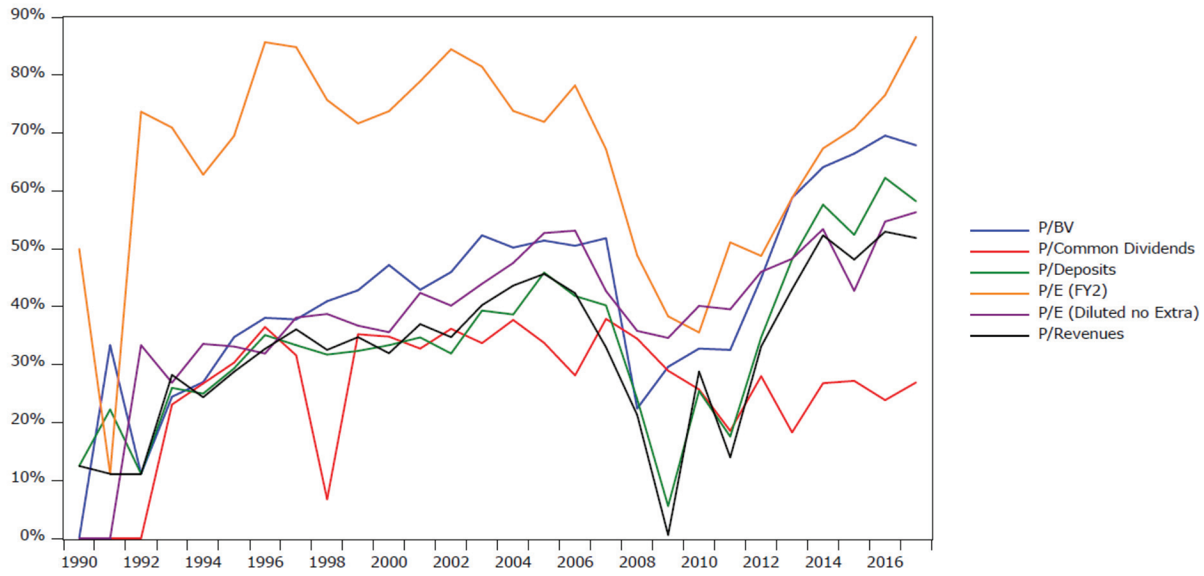
Graph 7 – Yearly multiples' performances for American Large Commercial Banks



Firstly, it is not so surprising to appreciate the excellent accuracy delivered by P/E (FY2) that every year overperforms all the other multiples. More interesting is the level of correlation between all the multiples, excluding P/Common Dividends that is quite stable and follows an individual path, which suggests similar reactions of multiples' performance to the same events. Moreover, it is evident that performances of multiples are negatively impacted around 2000, because of the explosion of the "dot-com bubble". Whereas, the effects of the 2007/2008 financial crisis are definitely more evident, signalling a huge decrease of accuracy. This means that the reaction of prices to the financial crisis was not homogeneous among banks in this subsample. After the crisis, it can be easily observed a recovery of performances, with multiples reaching interesting levels of accuracy in the more recent years. Indeed, it is remarkable to observe the low level of accuracy characterising all the multiples apart from P/E (FY2) during the Nineties, which instead, nowadays, is reaching very high levels. The combination of these elements suggests that restricting the analysis only to more recent years would definitely deliver stronger results than the one already achieved for American Large Commercial Banks. Suitability of multiples for these institutions is again confrmed.

Results for American Small Commercial Banks are messier, in particular during the first years, because very limited observations and a lack of data (Graph 8). However, general considerations are mostly similar.

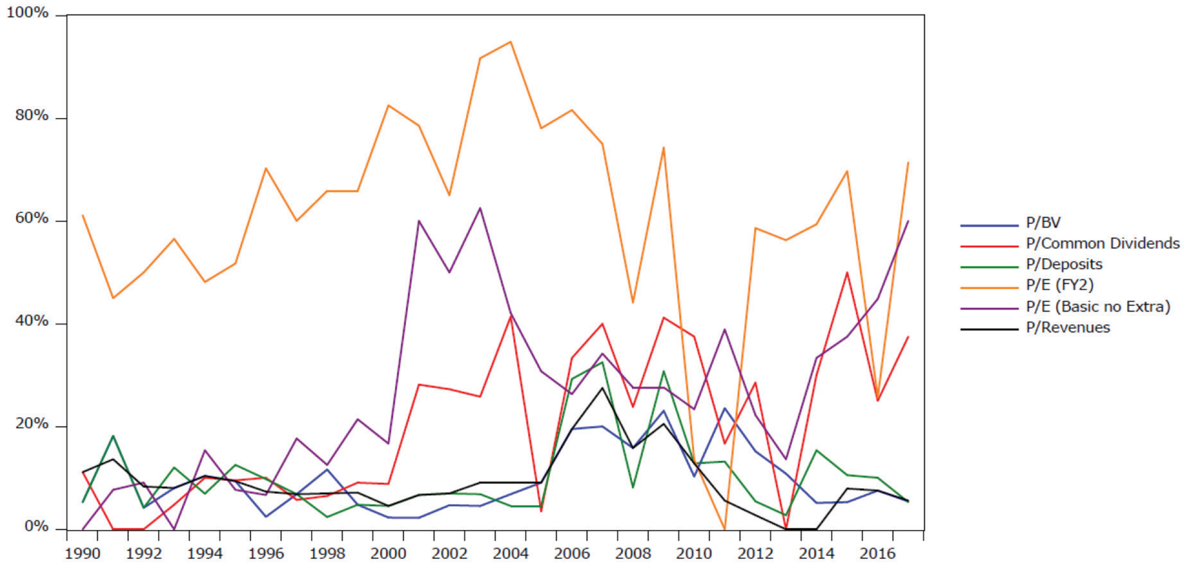
Graph 8 – Yearly multiples' performances for American Small Commercial Banks



The effects of the "dot-com" bubble are less evident here, but interestingly the performance of P/Common Dividends drops significantly in that period. It may be the consequence of different responses among banks in terms of dividend policy, (either in negative terms, because of accumulated losses and no availability of funds or in positive terms, to engage investors), generating high errors when basing valuation on dividends' multiples only. Conversely, the effects of the 2007/2008 financial breakdown are more visible, with the performance of deposits and revenues multiples dropping almost to zero. This is again a sign of heterogeneity among prices' reactions. However, performances registered in the last years, apart from P/Common Dividends suggests good applicability of multiples, in particular for P/E (FY2) and P/BV. In the end, correlation between movements is less evident in this subsample.

Finally, results for European Large Commercial Banks, the sole European subsample with a reasonable number of observations, are presented (Graph 9). The graph shows significant randomness and volatility among years, which is related to the already discussed low suitability of multiples for this group of banks, mainly due to high heterogeneity.

Graph 9 – Yearly multiples' performances for European Large Commercial Banks



Accuracy is not particularly brilliant, apart from earnings multiples which have already been identified as the most reliable for this group of banks. The positive effects of the introduction of the Euro, in particular for earnings multiples, can be here appreciated. However, they will be better scrutinised in the next section. Conversely, the effects of the "dot-com" bubble are quite negligible in this case, while the ones of the 2007/2008 are remarkable. Moreover, the graph shows relevant randomness during the period following this crisis. It may be mostly related to the sovereign-debt crisis, which strongly affected Portugal, Italy, Ireland, Spain and Greece. It is important to recall that during this period banks suffered extreme losses and many of them were bailed-out. Interestingly, the performance of P/E (FY2) drops to zero in 2011, low realiability of forecasts, due to the uncertainty of the economic envirnoment, and poor comparibility among banks, driven by the different economic conditions between Southern and Nothern Europe countries, are probably responsible of this negative impact. Overall, variability of multiples' performances across years is not negligible and their reaction during distressed periods may be significant.

4.3.6. The Effects of the Introduction of the Euro

The Euro was physically introduced as a common currency on the 1st of January 2002, while it was first created on the 1st of January 1999. From that moment on, the European Central Bank started operating to unify monetary policies across the member states.

The investigation here performed aims at understanding whether the implementation of these changes generated significant impacts over relative valuation performance. To implement this analysis, the period 1997-2006 has been selected to avoid distortions related to periods of crisis. After, it has been split into two 5-years subperiods: 1997-2001 (pre-Euro introduction) and 2002-2006 (post-Euro introduction). Therefore, the separation point coincides with the effective date in which the Euro started to circulate. Moreover, not all the banks included in the European dataset have been considered, since for many of them the introduction of Euro came later. Therefore, data were filtered considering only the 12 countries[7] that in the first place implemented together the project of having a common currency. Performances of multiples in the two different periods have been then computed, to observe the sign and the size of potential differences.

Looking at the results, it is clear how multiples' accuracy benefited from the implementation of a common currency for Large Commercial Banks (showing no worsening) and Investment Banks. Given their size and business model, these institutions are more likely to operate in different countries, which are characterised by a level playing field after the introduction of a common currency. Moreover, the introduction of

[7] Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain.

a common currency limited currency risks for banks, making also cheaper the access to capital markets. In addition, a unique monetary policy, setting a stable inflation target, drove interest rates down and increased their stability. Being value inversely proportional to the level of interest rates, these effects made value estimation easier and less discretionary, increasing multiples' performances. The overall level of homogeneity among comparables therefore increased, and this was particularly true for Large Commercial Banks and Investment Banks, which generally do not compete at a national level, being more geographically diversified. Finally, it is important to underline that the rank among multiples for these institutions does not show significant changes between the two periods analysed, apart from P/BV, which was the worst performer for Investment Banks before 2002. While forward P/E multiples are always the best performers and, interestingly, are the ones showing better improvements.

Conversely, the effects on Small Commercial Banks are less clear. This can be explained considering that these institutions are generally more focused on regional markets and compete on a national level. P/BV, P/TBV and dividends multiples show a decrease in accuracy, while earnings multiples register an increase.

4.3.7. The Effects of the 2007/2008 Financial Crisis

The worldwide effects of the 2007/2008 crisis were impressive: many banks went bankrupt and governemnt bail-outs were often necessary forcing them to run budget deficits, stock prices plummeted and unemployment surged, affecting every industry. It was the beginning of a global economic recession and of a long lasting sovreign-debt crisis in Europe: nowadays some Southern Europe countries still have to fully recover from the crisis. Taking Italy as an example: GDP growth still shows weak positive signs and the implementation of policies to boost growth and reduce government debt appears difficult to be achieved as long as political instability remains there.

This section focuses on the analysis of the effects of the financial crisis on valuation accuracy. The period 2003-2012 has been selected and it has been split into two 5-years subperiods: 2003-2007 (pre-financial crisis) and 2008-2012 (post-financial crisis). Therefore, the separation point coincides with Lehman Brothers' collapse. Performances of multiples in the two different periods are then computed to observe the sign and the size of potential differences.

The financial crisis had different effects on European Small Commercial Banks, depending on their level of international exposure and on their dependence on mortgages. In general, accuracy was badly hit, apart from trailing multiples that did slightly better. This can be related to market operators relying more on realized results than on expected results, which were surrounded by huge uncertainty.

European Large Commercial Banks, show a strong decrease in forward earnings multiples' accuracy, losing more than 20 and 45 percentage points at a 10% and 25% level respectively. Notwithstanding these multiples are still the best performers. Trailing multiples show a slightly better accuracy, but only at a 10% level. Interestingly, solvency-based multiples (P/BV and P/TBV) show greater accuracy, underlying analysts' attention on the level of capitalization of banks during the crisis. Indeed, large banks were largely affected by deteriorated and non-performing exposures, forcing them to account for massive write-downs. In addition, P/Common Dividends performed slightly better during the crisis, highlighting a focus on the capability of distributing dividends more than on the uncertain earnings achievable in the future.

Results for European Investment Banks, which, by definition, are strongly dependent on financial markets performances, show mostly a worsening of multiples' accuracy. P/E (FY2) is the multiple suffering the most in performances: it registers a decrease in accuracy at a 10% level higher than 40 percentage points. Small improvements are achieved when using P/Common Dividends and P/TBV and can be justified by market operators shifting their focus on cash flows and levels of capitalization.

Moving to American Commercial Banks, results show a strong worsening in multiples accuracy, highlighting how impressive the magnitude of the subprime market was in the United States. Both large and small commercial banks show negative performances for all the multiples, with the ones based on forward earnings suffering the most. Also American Investment Banks were affected by a decrease of the performance of almost every multiple and, in particular, of the ones based on earnings. Conversely, P/Revenues and P/Deposits show interestingly higher levels of accuracy during the crisis. An increase in the relevance of revenues may be related to analysts being more focused on the capabilities of these institutions in generating fees from a frozen M&A market and gains from extremely volatile stock markets. While the performance of P/Deposits is quite unexpected, since deposits are not a relevant measure for investment banks. This may imply that investment banks' business model was shifting to the one of retail banks. As a matter of fact, few days after the collapse of Lehman Brothers, the two major pure American Investment Banks, i.e., Goldman Sachs and Morgan Stanley, confirmed to become traditional bank holding companies, bringing an end to the era of pure investment banking on Wall Street.

4.3.8. Multiples' Ranking

We analyse multiples' performance during the last 28 years, mainly considering multiples' accuracy and the distribution of errors across different subsamples. Moreover, multiples' performance has been attentively scrutinised on an yearly basis, with a particular focus on specific periods (i.e., the introduction of the Euro and the 2007/2008 financial crisis) to catch performance's reactions. Combining the main findings deriving from these analyses here performed, it is possible to stipulate a ranking to show which multiple represents the best choice for each subsample. This can be considered as a useful summary tool for analysts when choosing the best multiples to perform relative valuation.

Supremacy of earnings multiples, in particular forward ones, is evident from the summary table (Table 2). Therefore, forward earnings should always be the first choice, while trailing earnings can be an acceptable alternative, only when forecasts are not available. Earnings excluding extraordinary items and including dilutive effects, when available, should always be preferred among the different measures of earnings. American Small Commercial Banks and Investment Banks are the unique exceptions, with P/BV and P/TBV, for the former group, and P/Common Dividends, for the latter, ranking above trailing earnings.

Table 2 – Multiples' Summary Ranking

		EU Investment Banks	EU Large Commercial Banks	EU Small Commercial Banks	US Investment Banks	US Large Commercial Banks	US Small Commercial Banks
Best choice	1	P/E (FY2)	P/E (FY2)	P/E (FY1)	P/E (FY2)	P/E (FY2)	P/E (FY2)
	2	P/E (FY1)	P/E (FY1)	P/E (FY2)	P/E (FY1)	P/E (FY1)	P/E (FY1)
	3	P/E (LTM Basic no Extra)	P/E (LTM Basic no Extra)	P/E (LTM Basic no Extra)	P/Common Dividends	P/E (LTM Diluted no Extra)	P/BV
	4	P/BV	P/Common Dividends	P/Common Dividends	P/E (LTM Diluted no Extra)	P/BV	P/TBV
	5	P/TBV	P/Deposits	P/Revenues	P/Deposits	P/TBV	P/E (LTM Diluted no Extra)
	6	P/Common Dividends	P/Revenues	P/Deposits	P/Revenues	P/Deposits	P/Revenues
	7	P/Deposits	P/BV	P/BV	P/BV	P/Revenues	P/Deposits
Worst choice	8	P/Revenues	P/TBV	P/TBV	P/TBV	P/Common Dividends	P/Common Dividends

Book value multiples work well also for American Large Commercial Banks and European Investment Banks, while they rank last in the other subsamples. However, it is important to recall that this low performance was magnified by the high levels of heterogeneity of European Commercial Banks. Moreover, P/TBV always ranks below P/BV, which highlights that the common practice of using a tangible measure of book value, eliminating intangibles, has no practical relevance. The remaining multiples, P/Common Dividends, P/Deposits and P/Revenues, never rank among the top performers, however their use could be still acceptable in some subsamples (i.e., European Commercial Banks and American Investment Banks), should other measures be not available. P/Common Dividends, as unique exception, ranks third for American Investment Banks, but at the same time it ranks last for American Commercial Banks, confirming distortions that can derive from the misuse of dividends.

5. Conclusions

We study the relative valuation accuracy of 1,118 listed and delisted banks across the United States and the Eurozone from 1990 to 2017. Multiples deliver strong valuation accuracy in the U.S. (in particular for Large Commercial Banks), while in Europe results are less univocal. Multiples based on forward earnings are the best performers and the one based on two years forecasts are the most accurate. However, the use of trailing earnings is quite often a valid second best option and diluted earnings not including extraordinary items should always be preferred among earnings measures. Despite practitioners consider P/TBV more reliable than P/BV, results show the opposite with the latter consistently overperforming the former. Moreover, the performance of these solvency-based multiples is very low in Europe, while they work quite well for American Commercial Banks. A very weak relationship between value and the amount of preferred dividends is also revealed with P/Common Dividends being a more precise tool than P/Total Dividends. Multiples based on Revenues and Deposits do not show particularly interesting performances.

We also investigate the historical performance of multiples. The effects of the financial crisis appear strongly negative in every subsample, while performances registered in recent years are at the highest levels. On the one hand, American Large Commercial Banks confirm the strong accuracy of P/E (FY2) that every year overperformed the other multiples. On the other hand, they register an increasing performance in the last 5 years for the multiples based on book value, trailing earnings, deposits and revenues. Finally, precision of different multiples appears to move in a correlate way, while P/Common Dividends tends to follow a proper path.

APPENDIX A – The 2007/08 Financial Crisis: Perfomance Statistics

	Pre-Financial Crisis (2003-2007)					Post-Financial Crisis (2008-20012)					Difference				
	Valuations within					Valuations within					Valuations within				
EU Investment Banks	10% of price	25% of price	50% of price	75% of price	90% of price	10% of price	25% of price	50% of price	75% of price	90% of price	10% of price	25% of price	50% of price	75% of price	90% of price
P/BV	20,8%	37,7%	73,6%	96,2%	96,2%	16,7%	29,2%	52,1%	87,5%	95,8%	-4,1%	-8,6%	-21,5%	-8,7%	-0,4%
P/TBV	13,2%	34,0%	73,6%	94,3%	94,3%	20,8%	37,5%	58,3%	87,5%	91,7%	7,6%	3,5%	-15,3%	-6,8%	-2,7%
P/Revenues	9,4%	20,8%	43,4%	77,4%	83,0%	2,1%	17,0%	44,7%	72,3%	85,1%	-7,3%	-3,7%	1,3%	-5,0%	2,1%
P/Deposits	10,0%	28,0%	56,0%	72,0%	78,0%	8,5%	31,9%	46,8%	68,1%	87,2%	-1,5%	3,9%	-9,2%	-3,9%	9,2%
P/Common Dividends	12,5%	35,0%	50,0%	85,0%	85,0%	15,4%	23,1%	53,8%	92,3%	92,3%	2,9%	-11,9%	3,8%	7,3%	7,3%
P/Total Dividends	12,5%	30,0%	52,5%	85,0%	85,0%	11,1%	33,3%	50,0%	72,2%	83,3%	-1,4%	3,3%	-2,5%	-12,8%	-1,7%
P/E (LTM Basic no Extra)	20,0%	37,8%	60,0%	84,4%	88,9%	12,1%	18,2%	36,4%	60,6%	81,8%	-7,9%	-19,6%	-23,6%	-23,8%	-7,1%
P/E (LTM Basic with Extra)	15,6%	35,6%	60,0%	84,4%	88,9%	9,1%	18,2%	33,3%	60,6%	81,8%	-6,5%	-17,4%	-26,7%	-23,8%	-7,1%
P/E (FY1)	44,1%	79,4%	88,2%	100,0%	100,0%	32,3%	61,3%	87,1%	93,5%	100,0%	-11,9%	-18,1%	-1,1%	-6,5%	0,0%
P/E (FY2)	54,5%	81,8%	87,9%	100,0%	100,0%	12,9%	54,8%	77,4%	90,3%	100,0%	-41,6%	-27,0%	-10,5%	-9,7%	0,0%
EU Large Commercial Banks															
P/BV	2,8%	11,7%	24,9%	49,3%	84,5%	5,5%	17,5%	47,0%	74,3%	82,5%	2,6%	5,7%	22,1%	25,0%	-2,0%
P/TBV	3,8%	9,9%	23,0%	42,7%	82,6%	4,4%	12,0%	40,4%	70,5%	83,1%	0,6%	2,2%	17,4%	27,8%	0,4%
P/Revenues	4,7%	14,6%	30,0%	53,5%	82,6%	4,8%	11,6%	28,0%	54,5%	83,1%	0,1%	-2,9%	-2,0%	1,0%	0,4%
P/Deposits	6,1%	15,0%	29,1%	51,2%	84,5%	5,8%	14,2%	37,9%	69,5%	80,0%	-0,3%	-0,8%	8,8%	18,3%	-4,5%
P/Common Dividends	10,3%	28,8%	52,1%	70,5%	85,6%	15,3%	30,5%	52,5%	76,3%	83,1%	5,0%	1,7%	0,5%	5,7%	-2,6%
P/Total Dividends	10,0%	28,7%	50,7%	70,0%	84,7%	7,1%	22,4%	41,2%	60,0%	76,5%	-2,9%	-6,3%	-9,5%	-10,0%	-8,2%
P/E (LTM Basic no Extra)	10,7%	35,3%	67,3%	82,0%	93,3%	16,9%	27,4%	52,4%	78,2%	88,7%	6,3%	-7,9%	-14,9%	-3,8%	-4,6%
P/E (LTM Basic with Extra)	12,7%	38,0%	67,3%	83,3%	93,3%	14,3%	26,2%	55,6%	78,6%	88,9%	1,6%	-11,8%	-11,8%	-4,8%	-4,4%
P/E (FY1)	39,4%	79,8%	95,9%	99,5%	100,0%	15,2%	33,8%	64,2%	86,1%	94,0%	-24,1%	-46,0%	-31,6%	-13,4%	-6,0%
P/E (FY2)	42,6%	84,2%	96,8%	100,0%	100,0%	19,0%	37,5%	62,5%	86,3%	95,8%	-23,6%	-46,7%	-34,3%	-13,7%	-4,2%
EU Small Commercial Banks															
P/BV	1,8%	4,9%	18,4%	48,4%	80,7%	0,9%	3,1%	12,1%	42,2%	69,5%	-0,9%	-1,8%	-6,3%	-6,3%	-11,2%
P/TBV	1,3%	4,5%	17,9%	45,7%	80,3%	0,9%	2,7%	12,1%	38,6%	69,5%	-0,4%	-1,8%	-5,8%	-7,2%	-10,8%
P/Revenues	5,5%	10,5%	29,5%	64,1%	81,8%	3,3%	10,5%	28,2%	53,6%	80,0%	-2,2%	0,0%	-1,4%	-10,5%	-1,8%
P/Deposits	4,6%	17,4%	36,1%	60,7%	82,2%	2,8%	9,6%	21,9%	47,0%	75,8%	-1,7%	-7,8%	-14,2%	-13,7%	-6,4%
P/Common Dividends	6,6%	11,9%	44,4%	68,2%	81,5%	3,3%	7,9%	19,2%	33,1%	46,4%	-3,3%	-4,0%	-25,2%	-35,1%	-35,1%
P/Total Dividends	5,7%	11,4%	42,4%	65,2%	81,6%	5,2%	7,6%	19,0%	34,2%	48,1%	-0,5%	-3,8%	-23,4%	-31,0%	-33,5%
P/E (LTM Basic no Extra)	7,4%	23,0%	51,1%	77,0%	83,0%	13,4%	31,1%	60,0%	74,1%	86,7%	6,0%	8,1%	8,9%	-3,0%	3,7%
P/E (LTM Basic with Extra)	7,4%	23,0%	50,4%	77,0%	83,0%	11,1%	28,9%	60,0%	74,1%	86,7%	3,7%	5,9%	9,6%	-3,0%	3,7%
P/E (FY1)	20,0%	46,7%	75,6%	95,6%	95,6%	23,9%	46,7%	66,7%	84,4%	88,9%	3,9%	0,0%	-8,9%	-11,1%	-6,7%
P/E (FY2)	19,6%	37,0%	80,4%	93,5%	97,8%	15,6%	39,1%	76,1%	89,1%	89,1%	-4,0%	2,2%	-4,3%	-4,3%	-8,7%

	Pre-Financial Crisis (2003-2007)					Post-Financial Crisis (2008-20012)					Difference				
	Valuations within					Valuations within					Valuations within				
US Investment Banks	10% of price	25% of price	50% of price	75% of price	90% of price	10% of price	25% of price	50% of price	75% of price	90% of price	10% of price	25% of price	50% of price	75% of price	90% of price
P/BV	16,1%	35,5%	71,0%	87,1%	96,8%	4,0%	32,0%	80,0%	88,0%	88,0%	-12,1%	-3,5%	9,0%	0,9%	-8,8%
P/TBV	12,9%	25,8%	45,2%	74,2%	90,3%	8,0%	20,0%	52,0%	76,0%	84,0%	-4,9%	-5,8%	6,8%	1,8%	-6,3%
P/Revenues	9,7%	22,6%	48,4%	77,4%	90,3%	16,0%	24,0%	52,0%	80,0%	88,0%	6,3%	1,4%	3,6%	2,6%	-2,3%
P/Deposits	12,9%	25,8%	77,4%	87,1%	90,3%	16,0%	44,0%	72,0%	88,0%	88,0%	3,1%	18,2%	-5,4%	0,9%	-2,3%
P/Common Dividends	9,7%	19,4%	51,6%	83,9%	87,1%	9,1%	18,2%	54,5%	72,7%	86,4%	-0,6%	-1,2%	2,9%	-11,1%	-0,7%
P/Total Dividends	9,7%	19,4%	51,6%	83,9%	87,1%	12,0%	16,0%	40,0%	80,0%	88,0%	2,3%	-3,4%	-11,6%	-3,9%	0,9%
P/E (LTM Diluted no Extra)	16,1%	38,7%	83,9%	90,3%	90,3%	9,1%	31,8%	59,1%	77,3%	86,4%	-7,0%	-6,9%	-24,8%	-13,0%	-4,0%
P/E (LTM Diluted with Extra)	16,1%	38,7%	83,9%	90,3%	90,3%	9,1%	27,3%	63,6%	77,3%	86,4%	-7,0%	-11,4%	-20,2%	-13,0%	-4,0%
P/E (LTM Basic no Extra)	16,1%	41,9%	80,6%	90,3%	90,3%	9,1%	31,8%	59,1%	81,8%	86,4%	-7,0%	-10,1%	-21,6%	-8,5%	-4,0%
P/E (LTM Basic with Extra)	16,1%	38,7%	80,6%	90,3%	90,3%	9,1%	27,3%	63,6%	81,8%	86,4%	-7,0%	-11,4%	-17,0%	-8,5%	-4,0%
P/E (FY1)	26,7%	40,0%	80,0%	100,0%	100,0%	12,5%	37,5%	75,0%	93,8%	100,0%	-14,2%	-2,5%	-5,0%	-6,3%	0,0%
P/E (FY2)	26,7%	33,3%	80,0%	100,0%	100,0%	6,3%	31,3%	81,3%	93,8%	100,0%	-20,4%	-2,1%	1,3%	-6,3%	0,0%
US Large Commercial Banks															
P/BV	20,3%	48,7%	77,0%	85,6%	91,4%	16,2%	39,3%	70,2%	84,9%	90,0%	-4,1%	-9,4%	-6,9%	-0,7%	-1,3%
P/TBV	16,6%	41,8%	73,2%	84,2%	90,4%	13,4%	34,4%	67,0%	84,4%	89,0%	-3,1%	-7,4%	-6,2%	0,3%	-1,5%
P/Revenues	20,3%	48,3%	74,5%	84,4%	90,6%	8,2%	26,0%	59,3%	84,2%	89,5%	-12,2%	-22,3%	-15,2%	-0,3%	-1,1%
P/Deposits	18,5%	45,9%	74,0%	83,5%	90,5%	9,5%	26,0%	58,9%	83,7%	90,0%	-9,0%	-19,9%	-15,1%	0,2%	-0,5%
P/Common Dividends	12,6%	35,1%	64,4%	79,5%	87,9%	11,3%	28,2%	52,4%	71,0%	84,3%	-1,3%	-6,9%	-12,0%	-8,4%	-3,6%
P/Total Dividends	13,2%	34,8%	63,9%	78,7%	87,7%	13,5%	33,6%	59,1%	78,7%	88,5%	0,3%	-1,3%	-4,8%	0,0%	0,8%
P/E (LTM Diluted no Extra)	28,7%	57,0%	75,2%	83,7%	90,9%	22,1%	45,2%	69,6%	84,8%	90,7%	-6,6%	-11,8%	-5,6%	1,1%	-0,2%
P/E (LTM Diluted with Extra)	27,9%	56,3%	74,9%	83,7%	90,8%	19,8%	43,7%	69,6%	84,3%	90,8%	-8,0%	-12,6%	-5,3%	0,6%	0,0%
P/E (LTM Basic no Extra)	27,9%	57,2%	75,6%	83,5%	90,8%	20,7%	44,7%	69,2%	84,7%	90,7%	-7,2%	-12,5%	-6,3%	1,2%	-0,2%
P/E (LTM Basic with Extra)	27,5%	56,6%	75,1%	83,6%	90,7%	19,1%	43,5%	69,3%	84,2%	90,7%	-8,5%	-13,1%	-5,8%	0,6%	0,0%
P/E (FY1)	45,5%	77,9%	94,7%	98,3%	99,1%	26,2%	54,5%	78,2%	91,2%	95,4%	-19,3%	-23,3%	-16,4%	-7,1%	-3,6%
P/E (FY2)	47,3%	80,5%	95,2%	98,7%	99,1%	32,3%	61,7%	84,2%	94,6%	97,5%	-15,0%	-18,8%	-11,0%	-4,1%	-1,6%
US Small Commercial Banks															
P/BV	20,3%	51,3%	80,8%	89,7%	92,7%	12,6%	32,3%	68,3%	85,8%	90,2%	-7,6%	-19,0%	-12,5%	-3,9%	-2,4%
P/TBV	20,7%	50,5%	80,5%	89,0%	93,0%	13,2%	33,2%	67,8%	85,7%	89,5%	-7,6%	-17,3%	-12,7%	-3,4%	-3,4%
P/Revenues	15,6%	41,1%	76,3%	87,4%	91,1%	6,7%	19,4%	41,6%	72,5%	88,5%	-8,9%	-21,7%	-34,7%	-14,9%	-2,6%
P/Deposits	15,3%	41,2%	74,6%	86,9%	91,1%	8,2%	21,3%	45,1%	76,5%	90,5%	-7,1%	-19,8%	-29,5%	-10,4%	-0,6%
P/Common Dividends	15,6%	34,2%	61,3%	80,4%	88,0%	13,0%	27,8%	54,8%	79,0%	88,3%	-2,6%	-6,4%	-6,5%	-1,4%	0,3%
P/Total Dividends	15,2%	34,9%	61,2%	79,8%	87,6%	14,0%	33,3%	57,0%	78,4%	89,5%	-1,2%	-1,5%	-4,2%	-1,4%	1,9%
P/E (LTM Diluted no Extra)	20,6%	48,1%	72,7%	83,7%	89,0%	17,5%	39,6%	64,3%	83,2%	90,5%	-3,1%	-8,4%	-8,3%	-0,4%	1,6%
P/E (LTM Diluted with Extra)	20,3%	47,6%	72,1%	83,3%	88,9%	17,2%	39,9%	64,3%	83,2%	90,5%	-3,1%	-7,7%	-7,7%	-0,1%	1,7%
P/E (LTM Basic no Extra)	21,4%	48,7%	72,1%	83,6%	88,9%	17,7%	39,6%	64,5%	82,9%	90,4%	-3,7%	-9,0%	-7,7%	-0,6%	1,5%
P/E (LTM Basic with Extra)	21,5%	47,9%	72,2%	83,3%	88,9%	17,2%	39,6%	64,3%	82,9%	90,5%	-4,3%	-8,3%	-7,8%	-0,4%	1,7%
P/E (FY1)	30,8%	70,8%	93,7%	98,6%	99,2%	18,4%	41,0%	70,9%	88,1%	94,3%	-12,4%	-29,8%	-22,9%	-10,5%	-4,9%
P/E (FY2)	36,3%	74,4%	93,0%	97,9%	99,1%	22,1%	43,8%	75,1%	90,8%	95,6%	-14,2%	-30,6%	-17,9%	-7,1%	-3,5%

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