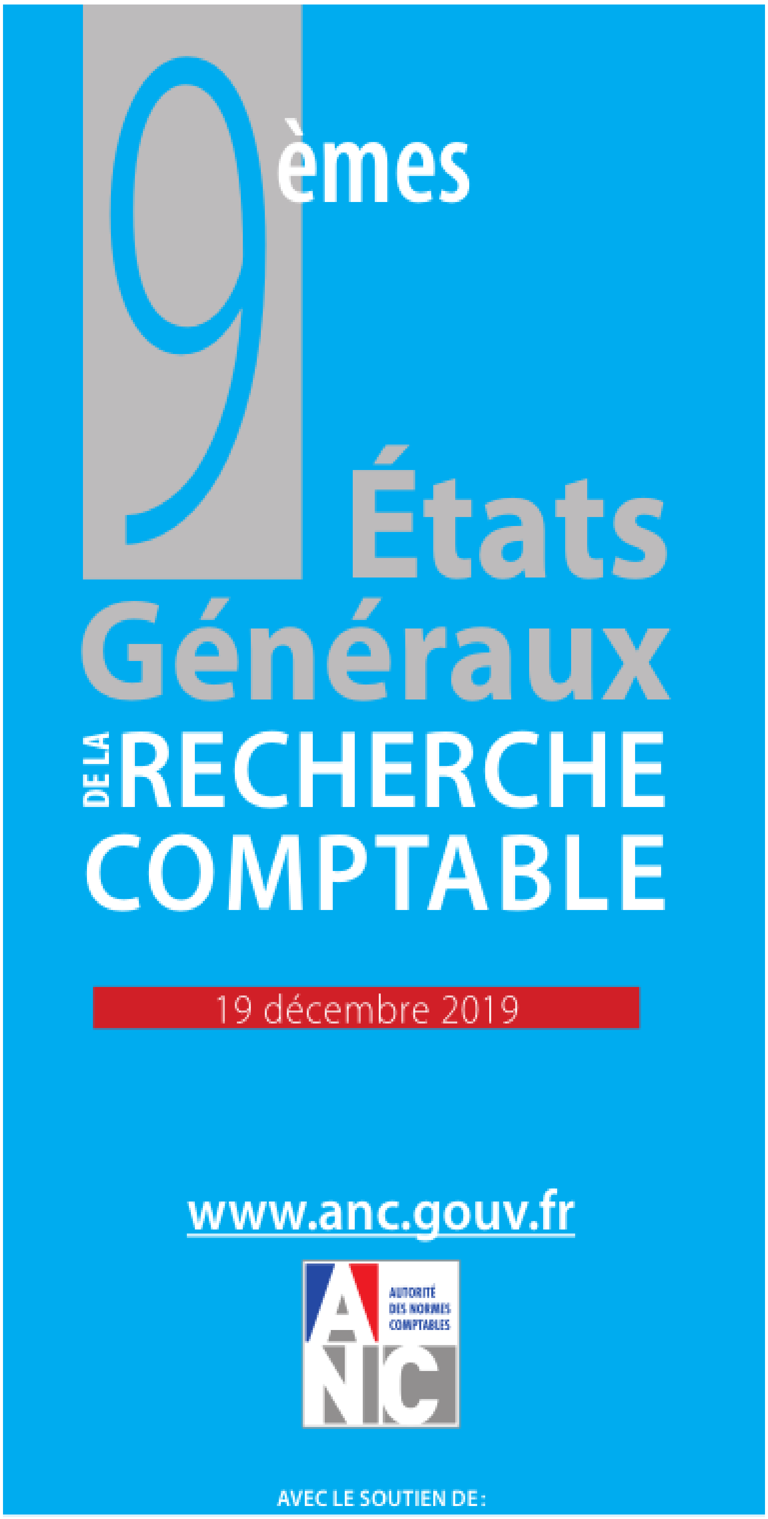

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Research paper

Valuation and discount rates under IFRS: does a size premium exist on the French market?

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Abstract

The size effect refers to the difference that can be observed between the returns of small-cap stocks, adjusted for risk, and those of large-cap stocks. First identified in 1981, this phenomenon has since been the subject of numerous studies with contrasting results. If it is proven to exist, it should be taken into account in actuarial valuation models, particularly with respect to IFRS. The results of this study do not directly highlight the existence of the size effect on the French market as described in other publications. However, such a size effect does exist and comes to light when it is cross-analysed with company quality. Like the quality effect, it constitutes a non-diversifiable risk that is not captured by the beta used in the capital asset pricing model (CAPM). The size effect and the quality effect thus constitute risk premiums that investors must take into account when estimating the discount rate.

Preamble

Accounting rules require actuarial calculations to be made for certain transactions, entailing the estimation of a discount rate. Quite early on, financial theorists came up with a model for estimating the latter: the capital asset pricing model, or « CAPM ». Soon afterwards, studies carried out to assess the relevance of this model revealed the existence of what is known as the « size effect »: a phenomenon whereby companies with small market capitalisations tend to generate higher returns than those expected under the CAPM, which has since been widely debated. However, this initial observation has led to the development of ad hoc models, which are widely used by accounting professionals and consist in increasing the discount rate obtained under the CAPM by a size premium.

The purpose of this paper is to confirm whether or not the size effect exists on the French market. After a review of the work published in this field, which covers 40 years of research (Section 1), we will examine the French market using an approach adapted to the country's situation (Section 2). Then, based on a revised method, which takes accounting data into consideration in assessing company quality, we look to review the existence and persistence of the size premium on the French market (Section 3)

1 Discount rates and valuation in accounting standards

Under IFRS, accounting teams are required to perform actuarial calculations on an ever more frequent basis. This type of calculation appears in particular under IFRS 13 (Fair Value Measurement), IAS 19 (Employee Benefits), IAS 36 (Impairment of Assets), IFRS 2 (Share-based Payment) and IFRS 9 (Financial Instruments).

In reality, this obligation, which consists in implementing discount rates, is mainly derived from guidelines adopted by accounting standard-setters, both in the United States (US GAAP) and on an international level (IFRS). It aims to promote the concept of fair value, i.e. a value based on the future income likely to be generated by an asset (whether tangible or intangible). However, this trend has led to a heated debate among academics in this field. Some authors, such as Beaver (1981), support this development (in line with the Chicago School of Economics), stressing that fair value accounting produces accounts that more closely reflect the reality of the financial markets. Others, on the contrary, are far more critical. Richard (2015), in particular, challenges the relevance of changes made to accounting models since 1800. He argues that these transitions from a static to a futuristic approach, with a dynamic approach in between, designed to foster an actuarial approach to calculating asset value, have always been made under pressure from short-term financial markets, and have thus contributed to weakening accounting models. Chiapello (2007), on the other hand, voices criticism of accounting standards that promote fair value and foster the prism of the financial markets.

While these constraints are considerable under US GAAP and IFRS, they also exist under French standards. Indeed, constraints with respect to the use of discount-rate techniques were extended to the European accounting framework through Directive 2013/34/EU of 26 June 2013, which was transposed into the French General Chart of Accounts (PCG) by way of Regulations Nos. 2015-06 and 2015-07 of 23 November 2015. These regulations require annual impairment tests to be carried out in both the parent company and consolidated financial statements for goodwill whose useful life is not defined. Under such circumstances, it is important to determine a discount rate, which must be applied to a series of future cash flows in order to determine a fair value (in the form of a value in use).

In this particularly demanding regulatory context, the question arises of how to implement these calculations effectively, starting with the issue of estimating the discount rate. Should a risk premium associated with the size of the company be taken into account or not? This question is crucial for the majority of accounting practitioners, who are often provided with valuation models that are (on the whole) relevant for large groups, but whose application to SMEs remains widely disputed.[1] The purpose of this paper is therefore to answer the practical questions of a significant number of chartered accountants regarding the application to unlisted SMEs of models often developed for large listed groups, for which the size discount is of little or no relevance.

One of the major breakthroughs in modern finance[2] was the establishment of the method for calculating the discount rate under the capital asset pricing model (CAPM), which defined the relationship between risk and return on an asset. According to the CAPM, the expected rate of return on an asset is directly related to its sensitivity to non-diversifiable risk, noted by the variable beta (β).

However, for several decades now, the CAPM has been the subject of much criticism (Lewellen, 2015), with some authors even arguing that it is « dead » (Fama and French, 1996). Conversely, others continue to support its relevance (Da et al., 2012). While alternative models have been put forward in academic publications and have led to a considerable amount of research, it must be acknowledged that these new approaches, mainly based on the work of Fama and French (1992), are still rarely used by practitioners (Jacobs, 2012). Levi and Welch (2017) also point out that, given the amount of information available on each company, there is always room to improve the explanatory power of the models, but that these improvements would only marginally contribute to increasing the R^2.

As early as 1981 (Banz, 1981), an anomaly concerning the predictive nature of the CAPM came to light: the size effect. Contrary to the predictions of the market model, various studies showed that the returns of small caps were in fact higher than predicted under the model.

The small size of companies was thus considered to be an additional risk factor that should be taken into account in the discount rate.[3] This idea can also be found in Fama and French's model (1993) in the form of the SMB (Small Minus Big) factor, which measures the profitability gap between small and large caps.

For valuators in general, and for accounting professionals subject to impairment tests in particular, the possible inclusion of this size premium is not without significance. By increasing the expected rate of return on an asset (i.e. the discount rate that will be used for its actuarial valuation), this premium reduces the value of the asset, all else being equal. This led to the

[1] It should be noted that, although accounting standards do not expressly refer to the discount rate of the entity as a whole (see IAS 36.55-57 which refers to the discount rate of the asset or cash-generating unit [CGU]), whether or not the entity's size is taken into account is a key issue: the size of the comparable companies selected, and therefore their assets or CGUs, is often greater than that of the company being measured, and therefore of its assets or CGUs being tested under IAS 36.

[2] Treynor (1961), Sharpe (1964).

[3] See section 2.3 for a presentation of the explanations provided in published works.

creation of ad hoc models for estimating the discount rate, consisting in increasing the rate resulting from the implementation of the CAPM by a size premium.

2 Publications dealing with the size effect

Since the publication of Banz's seminal work in 1981, the question has been raised of taking a size-related risk premium into account in the implementation of models for estimating future returns. In the early 1980s, Banz showed that the CAPM underestimated the profitability of small caps. Since this work was published, a great deal of research has been carried out on this subject, with some studies confirming the results, and others contradicting them (2.1). However, these results are subject to methodological criticism, which questions their validity (2.2). The explications given for a size premium, on the other hand, has been dealt with in a number of proposals (2.3).

2.1 Findings of empirical studies

Banz (1981) was the first to highlight the size effect. He studied U.S. companies listed on the NYSE from 1926 to 1975. On the basis of their market capitalisation, he classified them and divided them among 25 portfolios comprising the same number of stocks, the first group containing those with the highest market capitalisations and the last group those with the lowest. Each year, the portfolios were reconstituted on the basis of their most recent market capitalisation. He then calculated the profitability of each portfolio and compared it to what one would expect from each portfolio, taking into account their level of systematic risk, measured by their beta. This led him to measure the difference for each size portfolio between observed and expected returns. He noted that the more the size of the companies in the portfolios decreased, the more the gap between the two widened. The stocks in the smallest capitalisation portfolio had a risk-adjusted excess return of 0.40% per month. He concluded that the CAPM underestimates the expected returns of the stocks, especially as the company is small. He suggested as a possible explanation that investors do not wish to hold these stocks due to the limited information they have on these companies and demand a higher return to compensate for the risk involved.

Reinganum (1981) studied NYSE and AMEX (American Stock Exchange) stocks between 1963 and 1977. He found that the stocks in the smallest decile generated a monthly return that was 1.77% higher than those of the largest decile. Following on from these two studies, Brown et al. (1983) estimate this monthly outperformance to stand at 1.85%, Keim (1983) at 2.52%, and Lamoureux and Sanger (1989) at 1.70%. Fama and French’s study (1992), which analyses NYSE, AMEX and Nasdaq stocks over the 1963-1990 period, demonstrates that the returns of the smallest decile (1.52%) outperformed those of the largest decile (0.89%) by 0.63% per month. Hur et al. (2014) calculated a monthly premium of 1.90% between 1931 and 2006. Chan et al. (1985) observed a time-varying risk premium and explained that this variability was due to changes in economic conditions. In his study, Hirshleifer (2001) contends that although the size effect observed each year between 1974 and 1983 was significant, it was negative over the following seven years.

By using alternative measures of size, in particular accounting measures, Berk (1997) does not, however, highlight the relationship between size and profitability. Van Dijk’s study (2011), which reviews 30 years of research on the subject, highlights the disappearance of the size effect since the early 1980s, i.e. since it was identified by Banz (1981). Eleswarapu and Reinganum's study (1993) covering 1980 to 1990, Dichev's study (1998) covering 1980 to 1995, Horowitz et al.'s study (2000) covering 1979 to 1995 and Amihud's study (2002) covering 1980 to 1997 also fail to observe the existence of a size premium. According to Schwert (2003), this disappearance can be explained by the investment strategies of investors wishing to exploit this anomaly.

On the European stock market, over the period from 1990 to 2018, Peek (2019) notes that small companies outperformed large companies, with size being assessed in this instance by various measures in response to Berk's criticisms (1995, 1997). He also shows that the relationship between firm size and return is strongly non-linear, and that the firm size effect is more visible in Nordic and English-speaking countries.

Recently, a study based on revised methodology examined the firm size effect (Asness et al., 2018). To answer Berk's criticisms (1995, 1997), firm size is estimated based on different measures. However, the most innovative feature of the study is that it cross-references firm size with the quality of the companies concerned, identifying in particular stocks that can be described as « low-quality » (junk), quality being assessed on the basis of a score that mainly aggregates accounting data (see Appendix). This choice is explained by the fact that there is often confusion between size and quality, which hinders the identification of a relationship between size and expected returns. Large stocks tend to be of good quality while smaller ones may, more often, perform poorly. Thus, by classifying listed companies based on these two aspects, they observe that small stocks of good quality generate higher returns than expected and by comparison to large stocks of the same quality. Similarly, low-quality small caps have a higher excess return than large caps of the same quality. They conclude that the size effect has existed all along, but was simply masked by the quality effect.

2.2 Limitations of empirical studies

The results of empirical studies are thus mixed and subject to vast methodological criticism. For Berk (1995), the observations made with regard to the size effect are due to the fact that market capitalisation is an irrelevant measure of size when one wishes to highlight a lack of specification in the CAPM. Indeed, market capitalisation and future returns are somewhat correlated. Only a measure that is not based on market values would be capable of demonstrating the size effect. Consequently, no effect is observed when size is measured on the basis of the book value of assets and revenue.

Lo and MacKinlay (1990) and Black (1993) believe that this anomaly with respect to the CAPM predictions is the result of a data mining bias. This explanation is reinforced by the fact that the effect is not robust over time (Brown et al., 1983), and may even be negative, as was the case between 1941 and 1954 in the U.S. market (Handa et al., 1989). Focusing on a more recent period, Dimson and March (1999) document the disappearance of the size effect between 1983 and 1997. However, the data mining hypothesis is rejected by Zakamulin (2013) whose study of the American market between 1927 and 2010 shows that the size premium is predictable when certain macroeconomic variables are taken into account. Asness et al. (2018) replicate Banz's study (1981), using the same market and time period, and do not observe the size effect, which they reason is due to the improvement of the quality of the databases used. Based on their research, the size effect would never have existed in the study that led to this field of research.

Other studies flag up a concentration of this effect in January alone (Keim [1983], Lamoureux and Sanger [1989]) or among micro-capitalisations. For example, Horowitz et al. (2000) find that by removing companies with a capitalisation of less than $5 million from their sample, the size effect disappears. Knez and Ready (1997) show that this effect is due to the 1% of stocks with the lowest capitalisation. For others, it is the beta measure that is incorrect and underestimated, resulting in the observed profitability gap (De Mello and Souza, C. A., 2002).

For some, the results observed merely reflect a limited opportunity for investor arbitrage and not the existence of the size effect. Similarly, others believe that what is being observed is, in reality, merely the consequence of poor liquidity of the stocks in question. On the contrary, Asness et al. (2018) stress that by controlling the quality of the companies studied, this premium is found to be stable over time; it is not specific to micro-capitalisations nor associated with a January effect or specific size measure. These results thus lead them to reject the theory that the CAPM alone is able to predict a stock's profitability.

Similarly, for Kothari et al. (1995) and Shumway and Warther (1999), the observed effect is related to survivorship bias. By replicating Lamoureux and Sanger's study (1989), and reintegrating the stocks removed from the Nasdaq and not included in the database used, the size effect initially observed disappears.

Hou and van Dijk (2019), however, point out that the (ex-post) realised stock returns are a « noisy measure » of the (ex-ante) expected returns (Elton, 1999). Like Asness et al. (2018), but using a different method that incorporates accounting measures of profitability, they demonstrate a « resurrection » of the size effect, which does not appear when they adopt a classical approach to its measurement.

2.3 Attempts to explain the size effect

Several explanations have been put forward to justify this profitability gap between small and large caps, beyond what the CAPM predicts.

The most common explanation of this effect is that it is the counterpart to a higher systematic risk. This proposal of a link between the size effect and the risk premium appears in the first multifactor asset pricing models (Chan et al., 1985). Chan et al. suggest that the size effect corresponds to the remuneration of a risk, which is not taken into account in the traditional CAPM model. This theory is taken up by Fama and French (1992), who make it a central element of their three-factor model, through the SMB (Small Minus Big) factor. In this model, the size and book-to-market ratio explain the profitability of the stock, unlike the CAPM beta measure. Their subsequent studies reinforce this theory (Fama and French, 1993, 1995, 1996), by demonstrating their model's capacity to explain the profitability of portfolios assembled on the basis of size and the book-to-market ratio.

For others, this effect is not the result of a risk associated with a smaller size as such. For Pastor and Stambaugh (2003), the size effect is related to the lower liquidity of small caps, which is a source of transaction costs for investors. The size effect thus reflects the need for higher returns in order to cover these costs. As such, it is only the counterpart of a liquidity risk, which is systematic in nature and therefore non-diversifiable. For other authors, with respect to portfolio management, arbitrage opportunities on these stocks are limited due to their size, leading the market to undervalue them in order to hedge against the associated risk (Shleifer and Vishny, 1997). For Garleanu et al. (2012), this size effect is explained by the presence of technological growth options, which are more frequent in small caps. These options correspond to major technological innovations. However, they are, by nature, riskier because they generate more random effects than existing assets, and therefore require greater returns, which are not taken into account by the CAPM. The risk factor valued by the market is therefore not the small size of these stocks, but the presence of growth options.

Investor behaviour may also explain the existence of the size effect. Hur et al. (2014) show that the latter is greater in times of economic recession, as small caps become riskier. This observation is confirmed by Qadam and Aharon (2019), who link the size effect to market sentiment. Investor confidence, in a period of growth, leads them to invest more heavily in small caps in order to increase their risk exposure.

3 Assessing the size effect on the French market

The purpose of this preliminary study is to identify whether the size effect exists on the French market. In order to do so, we will first use the CAPM, based on Banz's model (1981). Then, and in order to take into account the asynchronous bias associated with small caps, we will implement the methodology of Ibbotson et al. (1997).

3.1 Data covered by the study

The study covers companies listed on the French market from January 1990 to December 2018, i.e. over 29 years. Over this period, we found there to be 1,221 listed companies, after eliminating financial companies, companies with negative equity and companies with a market capitalisation of less than €10 million. We excluded financial companies from the sample because their financial statements are not comparable to those of industrial and commercial companies. We eliminated companies with negative equity because they do not allow the calculation of certain ratios required for our study. Based on the Peek model (2019), we also eliminated companies whose market capitalisation, for the year in question, was less than €10 million. This decision is justified by the low liquidity of the stocks concerned, which results in a downward bias in beta calculations. The data studied is therefore not cylindrical, some companies will appear during the period and others will disappear due to stock market listings and delistings, thus avoiding survivorship bias (Brown et al., 1992). The subsequent portfolios were compiled and counted on 1 July of each year. Over the period, the number of companies varies between 324 (1990) and 735 (2000). The accounting and financial data was obtained from the Thomson Reuters Datastream database.

Table 1. Number of companies in the sample at the beginning of each year over the 1990-2018 period

Year	Number	Year	Number	Year	Number
1990	324	**2000**	735	**2010**	610
1991	334	**2001**	694	**2011**	601
1992	331	**2002**	594	**2012**	568
1993	345	**2003**	589	**2013**	560
1994	388	**2004**	581	**2014**	581
1995	400	**2005**	625	**2015**	597
1996	451	**2006**	677	**2016**	584
1997	518	**2007**	714	**2017**	593
1998	606	**2008**	644	**2018**	570
1999	657	**2009**	635	**-**	-

The number of companies was calculated on 1 July of each year from 1990 to 2018. The French sample selected features companies with market capitalisations of more than ten million euros and includes 1,221 different companies. However, the sample is not cylindrical; in other words, the companies present in 1990 were not necessarily present in 2018.

3.2 Portfolio compilation

A common approach to estimating risk premiums is to create portfolios by grouping companies together on the basis of the factor being studied; in this case, size. The creation of such portfolios allows for two types of comparisons. The first involves comparing the respective performance of the portfolio of small companies with that of the portfolio of large companies. The second involves comparing, for each portfolio, the observed performance with the expected performance, within the framework of an expected returns model, usually the CAPM.

On the U.S. market, deciles are generally determined on the basis of companies listed on the NYSE alone, with AMEX- and Nasdaq-listed companies being linked to the various portfolios, based on their market capitalisation, at a later stage. As a result, portfolios do not ultimately have the same number of stocks, and there is an inverse relationship between the average capitalisation of the companies in a portfolio and the number of companies contained therein. For example, in Hou and van Dijk's study (2019), the decile consisting of the largest capitalisations includes 155 stocks compared to 2,313 in the decile consisting of the smallest capitalisations.

In our study, the portfolios are compiled by ranking the companies in the sample according to their size, on 1 July of each year. In response to Berck's criticism (1995) of Banz's (1981) results, i.e. that they were based on the measurement of size by market capitalisation, we use three common measures of size: market capitalisation, the book value of shareholders' equity and the total assets. These companies are then divided into five portfolios, each containing the same number of companies. These portfolios are recompiled each year to take into account changes in the size of the listed companies, as well as stock market inflows and outflows. Thus, for a given year, the same company can be found in different quintiles depending on the measure of size used. In addition, and in order to take into account the mandatory transition to IFRS of companies listed on a regulated market and producing consolidated financial statements in 2005, we have defined two separate periods, the first from 1990 to 2004 and the second from 2005 to 2018. These standards may affect the way in which the book value of shareholders' equity and the total assets are calculated. This impact is particularly significant in the case of the treatment of goodwill, which was to be amortised until 2004, and is since only subject to an impairment test.

3.3 Methodology for calculating returns

The monthly returns of the resulting portfolios are calculated on the basis of the individual returns of the companies comprising them, on an equally weighted basis. The individual returns of the companies are estimated on the basis of their share price, adjusted for securities transactions, and take into account the possible distribution of a dividend.

We have chosen to use an average equity-weighted return for each portfolio, which is not weighted by the market capitalisation of each company. This decision can be explained by the fact that, having opted to use three measures of size, we did not consider it consistent to weight the individual returns of the companies using a single measure (for example, market capitalisation), and the weighting of each company was not relevant. Moreover, given that our goal was not to adopt a portfolio management approach, weighting by size would have been tantamount to stamping out the results of the smallest companies.

Thus, for a given measure of size (for example, market capitalisation), we built five portfolios with the same number of companies. The monthly return of each portfolio thus simply corresponds to the average of the returns of the companies comprising it. As indicated above, all calculations are made over two sub-periods, 1990-2004 and 2005-2018.

Table 2. Observed monthly portfolio returns, by size quintile, between 1990 and 2019

Size quintiles	Market capitalisation	Book value of shareholders' equity	Total assets
Period: 1990 - 2004			
1 (the smallest)	1.72%	1.79%	2.02%
2	2.08%	1.81%	1.73%
3	1.86%	1.58%	1.60%
4	2.03%	1.60%	1.50%
5 (the largest)	1.76%	1.58%	1.62%
Period: 2005 - 2018			
1 (the smallest)	1.06%	1.62%	1.55%
2	1.24%	0.81%	1.13%
3	1.31%	0.83%	0.77%
4	1.13%	0.99%	0.92%
5 (the largest)	1.06%	0.92%	0.88%

Using our French sample, we measured average performance by size quintile by identifying three distinct measures of size. French companies are classified according to their size in the sample based on (1) their market capitalisation, (2) the book value of their shareholders' equity and (3) their total assets. The average performance of each portfolio is measured on the basis of the monthly returns of each individual company.

The results vary according both to the measure of size chosen and the period studied (Table 2). When market capitalisation is used to measure size, no relationship is found between company size and observed returns. Over the 2005-2018 period, the average monthly return on the portfolios of the smallest and largest capitalisations is the same (1.06%). Using the other two measures, we find that small companies are more profitable than large ones, in line with observations made on some markets. However, this relationship is not linear and does not occur at the intermediate quintile level. It would therefore be unreasonable to assume that the size effect exists on the basis of these initial results, even when size is assessed on the basis of accounting data.

3.4 Methodology for estimating systematic market risk

The difference, for each size portfolio, between the observed and expected returns under the CAPM can be interpreted as the additional returns expected by the market to compensate for the risk associated with this size factor, regardless of market risk. The inference here is that the smaller a company is, the riskier it is considered to be, meaning that it must therefore provide a high return. However, a simple comparison of the returns generated by companies according to their size (Table 2) does not make it possible to estimate a possible size premium. Indeed, the difference in returns between companies of different sizes can be explained by differences in sensitivity to market risk. To differentiate between these two effects, it is therefore necessary to remove the effect related to market risk. For each capitalisation quintile, this means comparing the returns obtained with those expected, taking into account the systematic level of risk of each size portfolio, assessed through beta.

This consideration of systematic market risk requires the estimation of beta for each portfolio. Two approaches are used here. The first traditionally involves regressing the monthly return of the portfolios against the market's returns over 36 months. However, one of the frequent criticisms of this approach concerns the way in which beta is assessed. For Ibbotson et al. (1997), the beta of small caps is lower than it should be given their observed returns, in excess of the risk-free rate observed on the market. One explanation for this is that small caps are not listed on a daily basis due to the lack of market transactions, which would reduce the covariance of their returns with the market, and therefore reduce their beta. To correct this data asynchronous bias, Ibbotson et al. (1997) suggest estimating an adjusted beta (« sum beta ») that takes into account the time lag in the integration of market changes into the share price of small caps.To do this, based on the work of Scholes and Williams (1977) and Dimson and Marsh (1983), they regress the stock's returns against the market's returns over the same period, according to the usual method for estimating beta, but also regress them against the market's returns over the previous period. This results in the following multiple regression:

$$r_{i,t} - r_{f,t} = \alpha_i + \beta_1(r_{M,t} - r_{f,t}) + \beta_2(r_{M,t-1} - r_{f,t-1}) + \epsilon_{i,t}$$

where $(r_{i,t} - r_{f,t})$ is the return on stock i in excess of the risk-free rate, αi is the regression constant, βi.0 is the beta of stock i, βi.-1 is the beta of the stock estimated with a one-period lag, Rm,0 is the market return and Rm,-1 is the market return estimated with a one-period lag. The sum of the two regression coefficients results in an adjusted beta, which they call « sum beta »: Sum $\beta = \beta_1 + \beta_2$

Table 3. Beta of each portfolio, by size quintile, between 1990 and 2018, according to different measures of size

		CAPM		Sum of Ibbotson et al.			
		$\beta_{i,t}$	R^2	$\beta_{i,t}$	$\beta_{i,t-1}$	$\beta_{i,t}+\beta_{i,t-1}$	R^2
Market capitalisation	Period: 1990 - 2004						
	Q1 (small)	0.28	0.10	0.26	0.47	0.73	0.36
	Q2	0.30	0.12	0.28	0.48	0.76	0.41
	Q3	0.32	0.13	0.30	0.46	0.76	0.40
	Q4	0.36	0.15	0.34	0.46	0.80	0.40
	Q5 (large)	0.43	0.26	0.41	0.37	0.78	0.46
	Period: 2005 - 2018						
	Q1 (small)	0.41	0.17	0.36	0.51	0.87	0.43
	Q2	0.51	0.23	0.45	0.52	0.97	0.46
	Q3	0.49	0.18	0.43	0.56	0.99	0.42
	Q4	0.57	0.30	0.52	0.49	1.01	0.52
	Q5 (large)	0.69	0.37	0.65	0.44	1.08	0.52
Book value of shareholders' equity	Period: 1990 - 2004						
	Q1 (small)	0.46	0.13	0.43	0.62	1.05	0.35
	Q2	0.42	0.13	0.39	0.54	0.94	0.36
	Q3	0.31	0.13	0.29	0.45	0.74	0.40
	Q4	0.25	0.12	0.24	0.38	0.62	0.40
	Q5 (large)	0.21	0.10	0.20	0.36	0.56	0.38
	Period: 2005 - 2018						
	Q1 (small)	0.70	0.16	0.64	0.61	1.25	0.28
	Q2	0.51	0.21	0.45	0.56	1.02	0.46
	Q3	0.50	0.25	0.44	0.49	0.94	0.49
	Q4	0.52	0.28	0.47	0.46	0.93	0.50
	Q5 (large)	0.44	0.30	0.40	0.43	0.82	0.57
Total assets	Period: 1990 - 2004						
	Q1 (small)	0.28	0.06	0.25	0.46	0.71	0.23
	Q2	0.35	0.11	0.33	0.49	0.82	0.32
	Q3	0.26	0.09	0.24	0.46	0.70	0.37
	Q4	0.31	0.14	0.29	0.48	0.76	0.46
	Q5 (large)	0.39	0.23	0.37	0.41	0.77	0.47
	Period: 2005 - 2018						
	Q1 (small)	0.50	0.11	0.43	0.61	1.05	0.28
	Q2	0.45	0.17	0.41	0.43	0.84	0.31
	Q3	0.46	0.23	0.41	0.48	0.89	0.46
	Q4	0.53	0.25	0.47	0.54	1.01	0.52
	Q5 (large)	0.67	0.36	0.62	0.49	1.11	0.55

Two risk estimation models are used here. The first is the market model where $r_{i,t} - r_{f,t} = \alpha_i + \beta\left(r_{M,t} - r_{f,t}\right) + \epsilon_{i,t}$. The second model is that of Ibbotson et al. (1997) in which $r_{i,t} - r_{f,t} = \alpha_i + \beta_1\left(r_{M,t} - r_{f,t}\right) + \beta_2\left(r_{M,t-1} - r_{f,t-1}\right) + \epsilon_{i,t}$. The R^2 indicates the coefficient of determination that measures the explanatory power of both models. The R^2 is adjusted by the number of factors and allows the comparability of the explanatory power of the two models. The latter is measured as follows: $adj.R^2 = [(1-R^2)](n-1)]/(n-k-1)$ where n is the number of observations and k the number of factors used in the regression.

As before, we distinguish between three measures of size and divide our observations into two sub-periods. Compared to beta estimated in the usual manner, by means of the « sum beta » method, we observe an increase in the latter, which is generally all the more significant when the company’s size is small. When size is assessed on the basis of market capitalisation, the beta of small caps increases from 0.28 to 0.73, while it only increases by 0.35 for large caps. By correcting the weakness of the initial betas, « sum beta » makes it possible to better assess the systematic risk of small stocks. This enhanced risk assessment is reflected in a higher explanatory power, measured by the coefficients of determination adjusted for the number of variables used in the multi-variable linear regressions. Although the Ibbotson et al. model (1997) provides a more reliable estimate of the systematic risk of French stocks by size quintile, the model remains imperfect. Indeed, only 36% of the returns on stocks in the first size-quintile are explained. While this result remains higher than the market model, in which only 10% are explained, small stocks continue to be the most difficult assets to analyse. In addition to the low explanatory power that these models offer for the small-cap quintiles, they provide counter-intuitive results. While there should be a decreasing relationship between size (measured on the basis of market capitalisation) and beta, we instead observe an increasing relationship when size is measured by capitalisation, unlike what is observed in other markets. The systematic risk of small caps on the French market would therefore appear to be lower than that of large caps. This result applies to both risk estimation models.

When size is measured by the book value of shareholders' equity, beta is, on the other hand, higher when size is small, in line with what is to be expected. However, the explanatory power of the model is low when the CAPM is used. In the case where the total assets are used to measure size, the results are again in contradiction with what is expected, with beta proving to be higher as the size of the company increases.

One possible explanation for this observation is the low liquidity of the French equity market. Beta does not measure the total risk associated with a stock or portfolio, but rather its systematic risk, i.e., its sensitivity to market fluctuations. However, for less liquid stocks, this low sensitivity may be due to a limited trading frequency, rather than to a decorrelation of the stocks' movements relative to those of the market.

3.5 The size effect on the French market

In order to highlight the possible size effect on the French market, and assuming that the calculated beta is a correct measure of the systematic risk of the portfolios, the observed returns are compared to those expected under the CAPM:

$$\text{Size effect} = \text{Observed returns} - (\text{risk-free rate} + \text{beta} \times \text{market risk premium})$$

This size effect is estimated for each portfolio. As before, we used three measures of size, in addition to two beta estimation models, and observed two sub-periods.

Table 4. Difference in portfolio returns, between 1990 and 2018

		CAPM	Sum of Ibbotson et al.	CAPM	Sum of Ibbotson et al.
		Expected return	Expected return	Size effect	Size effect
Market capitalisation	Period: 1990 - 2004				
	Q1 (small)	0.24%	0.62%	1.48%	1.10%
	Q2	0.26%	0.64%	1.82%	1.44%
	Q3	0.28%	0.65%	1.58%	1.21%
	Q4	0.30%	0.68%	1.73%	1.35%
	Q5 (large)	0.36%	0.67%	1.40%	1.09%
	Period: 2005 - 2018				
	Q1 (small)	0.31%	0.64%	0.75%	0.42%
	Q2	0.38%	0.72%	0.86%	0.52%
	Q3	0.37%	0.74%	0.94%	0.57%
	Q4	0.42%	0.75%	0.71%	0.38%
	Q5 (large)	0.51%	0.80%	0.55%	0.26%
Book value of shareholders' equity	Period: 1990 - 2004				
	Q1 (small)	0.39%	0.89%	1.40%	0.90%
	Q2	0.36%	0.80%	1.45%	1.01%
	Q3	0.26%	0.63%	1.32%	0.95%
	Q4	0.22%	0.52%	1.38%	1.08%
	Q5 (large)	0.18%	0.47%	1.40%	1.11%
	Period: 2005 - 2018				
	Q1 (small)	0.52%	0.78%	1.10%	0.84%
	Q2	0.38%	0.70%	0.43%	0.11%
	Q3	0.37%	0.55%	0.46%	0.28%
	Q4	0.38%	0.46%	0.61%	0.53%
	Q5 (large)	0.33%	0.41%	0.59%	0.51%
Total assets	Period: 1990 - 2004				
	Q1 (small)	0.23%	0.60%	1.79%	1.42%
	Q2	0.30%	0.70%	1.43%	1.03%
	Q3	0.22%	0.60%	1.38%	1.00%
	Q4	0.26%	0.65%	1.24%	0.85%
	Q5 (large)	0.33%	0.66%	1.29%	0.96%
	Period: 2005 - 2018				
	Q1 (small)	0.37%	0.53%	1.18%	1.02%
	Q2	0.34%	0.61%	0.79%	0.52%
	Q3	0.34%	0.52%	0.43%	0.25%
	Q4	0.39%	0.57%	0.53%	0.35%
	Q5 (large)	0.50%	0.57%	0.38%	0.31%

We made two estimates regarding the expected returns using the market model where $r_{i,t} - r_{f,t} = \alpha_i + \beta(r_{M,t} - r_{f,t}) + \epsilon_{i,t}$ and the Ibbotson et al. model (1997), where $r_{i,t} - r_{f,t} = \alpha_i + \beta_1(r_{M,t} - r_{f,t}) + \beta_2(r_{M,t-1} - r_{f,t-1}) + \epsilon_{i,t}$. Using sensitivity coefficients calculated from historical data, the expected returns for the five size quintiles, according to the measure of size, are presented. The deviation corresponds to the difference between the observed returns and those estimated by the two models.

For each portfolio, we estimated the expected returns under the traditional CAPM and using the *"sum beta"* method. We then calculated the difference between the observed returns (Table 2) and the expected returns, in order to highlight a possible misspecification in the model, which might reveal a pattern representative of a size-related risk premium. The larger the size, the smaller the expected gap should be.

In line with previous results, no size effect consistent with financial theory is observed when market capitalisation is used. While we should observe a smaller gap in returns as the size increases, the results observed do not show a linear relationship between the quintiles. Using the « sum beta » method, on the basis of market capitalisation and over the 1990-2004 period, the difference in returns is 1.10% per month for small caps, compared to 1.09% for large caps and 1.44% for the second quintile. There are two possible explanations that justify the lack of observation of the size effect.

The first is of an empirical nature and supposes that the absence of the size effect is related to the size-quality composition effect. If stock returns can be affected by size and market risk, they can also be affected by other factors. This additional factor would cover the consequences of the first two, and would explain the fact that, on the French market, no size effect has been observed. This explanation is put forward by Asness et al. (2018), for whom quality is also a key factor in explaining companies' stock market returns, in addition to their systematic level of risk.

The second explanation challenges, in substance, the empirical methodologies used to measure the size effect, which assume that the observed returns are representative of the returns expected by investors. They would only be « noisy measures » of the expected returns, adjusted for risk (Campbell, 1991; Elton, 1999). On this basis, and after adjusting the observed returns to obtain a more accurate picture of the expected returns, Hou and van Dijk (2019) highlight the size effect, which does not arise when measured on the basis of the observed returns.

4 A revised approach to the size effect

In order to take into consideration the substantial criticism, both conceptual and empirical, that has been levelled at studies on the size effect, we have opted for a revised approach to assessing the latter, based on the notion of company quality.

Asness et al. (2018) note that large firms are, on average, considered to be of good quality while small caps are, on the other hand, are considered to be of poor quality (« junk stocks »). Their interpretation of the quality effect thus contradicts that of Banz (1981), for whom small market capitalisations are associated with higher returns. However, if these small caps are of poor quality, they should, on the contrary, underperform. Thus, Asness et al. (2018) argue that the basic size effect is fighting against the strong quality effect, which leads them to suggest comparing the two components in order to better identify their respective effects.

They define quality as a characteristic or set of characteristics of an asset for which, all else being equal, investors are willing to pay more (Asness et al., 2019). They measure this quality criterion based on profitability, growth, safety and payout.

This methodology allows for this size-quality struggle to be taken into account, which explains much of the criticism of the size effect in related publications and allows them to observe that the size effect is stronger when the quality effect is controlled.

Asness et al (2019) assess quality on the basis of four measures, which are each attributed a score (see the Appendix for a more detailed description of these scores):

- ***Profitability*** (*P*). All else being equal, companies with high profitability accounting ratios record, on average, higher stock market returns. This corresponds to the gross profitability effect introduced by Chen, Novy-Marx and Zhang (2011) and Novy-Marx (2013). Six measures are used to assess profitability: gross profits over assets (GPOA), return on equity

(ROE), return on assets (ROA), cash-flow over assets (CFOA), gross margin (GMAR), and low accruals (ACC).

- ***Growth*** (G). Investors should pay a higher price for stocks with strong profitability growth. The latter is assessed over a three-year window. More specifically, we measure growth for each measure that constitutes the « Profitability » variable. To do so, we divide the numerator t by a denominator lagged by three years $(t - 3)$.

- ***Safety*** (S). The S variable determines, by way of its criteria, companies that are safer for investors, who are expected to pay a higher price for stocks with lower risk. Asness et al (2019) suggest estimating a stock's level of safety by assessing its β under the CAPM (BAB), its idiosyncratic volatility σ_ε (IVOL), its ROE volatility (EVOL) and its leverage (LEV).

- ***Payout*** (O). Asness et al. (2019) argue that the level of cash flows to investors is determined by management and is a reliable measure of the attractiveness of a stock to its shareholders. This dimension constitutes a distribution score including net equity issuance (EISS), net debt issuance (DISS) and total net payout over profits (NPOP).

In order for each criterion to be comparable, we calculate the value of each variable and then classify them to establish their rank (r_x). We then standardise this rank by deducting the average rank and dividing it by the standard deviation of the ranks:

$$z_x = [r_x - \overline{r_x}]/\sigma(r_x)$$

The scores are calculated as follows:

- $P = z(z_{\text{GPOA}} + z_{\text{ROE}} + z_{\text{ROA}} + z_{\text{CFOA}} + z_{\text{GMAR}} + z_{\text{ACC}})$
- $G = z(z_{\Delta\text{GPOA}} + z_{\Delta\text{ROE}} + z_{\Delta\text{ROA}} + z_{\Delta\text{CFOA}} + z_{\Delta\text{GMAR}} + z_{\Delta\text{ACC}})$
- $S = z(z_{BAB} + z_{LEV} + z_{IVOL} + z_{EVOL})$
- $O = z(z_{\text{EISS}} + z_{\text{DISS}} + z_{\text{NPOP}})$

The quality measure (Q) is then calculated as follows:

$$Q = z(z_P + z_G + z_S + z_O)$$

In this study, to differentiate between the size effect and the quality effect, the companies in the sample are classified according to these two dimensions: size and quality. Size is measured here by market capitalisation, and quality by the Q score. Due to this dual characterisation, it is no longer possible to divide companies into five size portfolios. We use a quartile breakdown here, with size premiums being assessed by comparing the first and last quartiles (Q1 - Q4).

Table 5. Monthly returns, in excess of the risk-free rate, of each portfolio compiled according to the independent intersection of size and quality

		Period: 1990 - 2004				
		Quality				
		Q1 (low)	Q2	Q3	Q4 (high)	Quality effect: Q4-Q1
Size	Q1 (small)	2.45%	2.62%	2.69%	2.97%	0.51%
	Q2	1.48%	1.99%	1.77%	1.93%	0.45%
	Q3	1.46%	1.54%	1.45%	1.40%	-0.06%
	Q4 (large)	0.48%	1.31%	1.27%	0.47%	-0.01%
	Size effect: Q1-Q4	1.97%	1.31%	1.42%	2.49%	

		Period: 2005 - 2018				
		Quality				
		Q1 (low)	Q2	Q3	Q4 (high)	Quality effect: Q4-Q1
Size	Q1 (small)	2.14%	1.77%	2.22%	1.93%	-0.22%
	Q2	1.18%	1.33%	1.53%	1.82%	0.64%
	Q3	1.35%	1.38%	1.22%	1.29%	-0.05%
	Q4 (large)	0.63%	0.71%	1.15%	0.60%	-0.03%
	Size effect: Q1-Q4	1.52%	1.07%	1.08%	1.33%	

The table presents the average monthly ex-post returns on stock portfolios following independent double sorting between size, measured by market capitalisation, and quality. This double sorting into four respective quartiles produces sixteen portfolios. The performances of the above portfolios are divided into two sub-periods: 1990 - 2004 and 2005 - 2018.

While no size effect was observed by classifying stocks according to this method alone, taking quality into account does highlight a premium, in line with the results observed by Asness et al. (2018). When companies are considered to be of good quality over the 1990-2004 period, the excess monthly average returns of small caps (2.97%) are 2.49% higher than those of large caps (0.47%). The same applies to those that can be classified as poor quality, which show a monthly difference of 1.97%. For almost all levels of quality, with the exception of Q1 and Q2 over 2005-2018, we observe excess returns, which are more significant as the size of the companies decreases. Over the 2005-2018 period, excess returns thus increase successively from 0.60% for the largest companies (Q4), to 1.29% (Q3), 1.82% (Q2) and finally to 1.93% for the smallest companies (Q1).

Conclusion

Under current IFRS, actuarial calculations and the advance assessment of discount rates are frequently required. The latter is generally calculated using the CAPM. However, since Banz's work (1981), it is common for accounting professionals to add a risk premium in relation to the company's size. The smaller the company, the higher the premium.

The purpose of our research was to examine whether or not such a premium exists on the French market. To address frequent arguments raised in relation to other works on this subject, we selected three measures of size, two methods for estimating the systematic risk of the portfolios, and two sub-periods to account for the potential impact of the mandatory transition to IFRS as of 1 January 2005. In any case, we did not observe the existence of a size premium. Like Asness et al. (2018), we cross-analysed the company size criterion with that of company quality. In doing so, the size effect proved significant. Where quality was deemed to be identical, portfolios including small companies showed higher returns than those containing large companies.

For practitioners, the main finding of this work is that the use of ad hoc models, consisting of mechanically adding a size premium to the CAPM results, is not relevant. If a size premium does exist, it must be put in perspective with the quality of the company concerned.

Appendix

Methods used to assess the quality of companies

This section outlines the methods used to assess the different variables chosen to calculate the quality score, which is itself the sum of four scores (Profitability, Growth, Safety and Payout):

$$\boldsymbol{Q} = \boldsymbol{z}(\boldsymbol{z_P} + \boldsymbol{z_G} + \boldsymbol{z_S} + \boldsymbol{z_O})$$

The methods used for calculating these scores are based on those adopted by Asness et al. (2019). To estimate the score (z) of a variable (x) at a given date (t), all the values of the variable studied, for all the companies and years, are ranked in ascending order:

r_x = rank (x).

This rank is then standardised to obtain an average equal to zero and a standard deviation of one:

$$z(x) = z_x = [r_x - \overline{r_x}]/\sigma(r_x)$$

The data was obtained from the Thomson Reuters Datastream database.

Profitability

The company's P (Profitability) score is the sum of 6 measures:

$$\boldsymbol{P} = \boldsymbol{z}(\boldsymbol{z}_{\mathbf{GPOA}} + \boldsymbol{z}_{\mathbf{ROE}} + \boldsymbol{z}_{\mathbf{ROA}} + \boldsymbol{z}_{\mathbf{CFOA}} + \boldsymbol{z}_{\mathbf{GMAR}} + \boldsymbol{z}_{\mathbf{ACC}})$$

1. Gross profits over assets (GPOA):

$$GPOA = \frac{revenue - costs\ of\ goods\ sold}{total\ assets}$$

2. Return on equity (ROE):

$$ROE = \frac{net\ income}{book\ equity}$$

3. Return on assets (ROA):

$$ROA = \frac{net\ income}{total\ assets}$$

4. Cash flow on assets (CFAO):

$$CFAO = \frac{net\ income + depreciation - \Delta\, working\ capital - capital\ expenditures}{total\ assets}$$

5. Gross margin (GMAR):

$$GMAR = \frac{revenue - costs\ of\ goods\ sold}{total\ sales}$$

6. Accruals (ACC)

$$ACC = \frac{depreciation - \Delta\, working\ capital}{total\ assets}$$

Growth

G represents the company's growth score based on the variation of five measures over three years:

$$\boldsymbol{G} = \boldsymbol{z}(\boldsymbol{z}_{\Delta\mathbf{GPOA}} + \boldsymbol{z}_{\Delta\mathbf{ROE}} + \boldsymbol{z}_{\Delta\mathbf{ROA}} + \boldsymbol{z}_{\Delta\mathbf{CFOA}} + \boldsymbol{z}_{\Delta\mathbf{GMAR}} + \boldsymbol{z}_{\Delta\mathbf{ACC}})$$

For example, the change in the GPOA ratio is calculated as follows:

$$\Delta GPOA = \frac{Gross\ profit_t - Gross\ profit_{t-3}}{total\ assets_{t-3}}$$

Safety

The third score, *S* (Safety), is based on four variables:

$$\boldsymbol{S} = \boldsymbol{z}(\boldsymbol{z}_{BAB} + \boldsymbol{z}_{LEV} + \boldsymbol{z}_{IVOL} + \boldsymbol{z}_{EVOL})$$

According to Asness et al. (2019), a quality stock is also a stock that offers a high level of safety. This measure is based on four criteria. The stock must have a low market beta in line with the BAB investment strategy for « betting against beta » (Frazzini and Pedersen, 2014). The authors point out that it is possible to generate high returns, not captured by the market model, by buying low-beta stocks and by financing this operation by shorting high-beta stocks. The betas here were estimated based on the ex-post CAPM – where $r_{i,t} - r_{f,t} = \alpha_i + \beta_i(r_{M,t} - r_{f,t}) + \varepsilon_{i,t}$ over a period of three years. This estimate is made for each stock annually using movable timeframes. The BAB criterion, in our sample, thus indicates the classification of a stock on the basis of its systematic risk. Remaining within the framework of this model, low idiosyncratic volatility (IVOL) is considered to be a safety criterion. This involves classifying French equities according to a dispersion score based on their residuals, i.e. $\varepsilon_{i,t} = [r_{i,t} - r_{f,t}] - \beta_i(r_{M,t} - r_{f,t})$. In other words, for each individual stock and over a three-year timeframe, we measured the standard deviation of the residuals (σ_ε). Low idiosyncratic volatility means lower risk and therefore a higher level of safety. Idiosyncratic volatility is standardised in the form of a z score, like the other variables. The safety of a stock hinges on a low gearing ratio, or « LEV » (ratio between long-term debt and the book value of shareholders' equity). The volatility of return on equity (ROE) is measured by its standard deviation, again over a three-year timeframe.

Payout

The *O* score measures the level of cash flows to all investors, be they shareholders or financial creditors:

$$\boldsymbol{O} = \boldsymbol{z}(\boldsymbol{z}_{\mathbf{EISS}} + \boldsymbol{z}_{\mathbf{DISS}} + \boldsymbol{z}_{\mathbf{NPOP}})$$

The variable constitutes a distribution score including net equity issuance (EISS), net debt issuance (DISS) and the total net payout over profits (NPOP).

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