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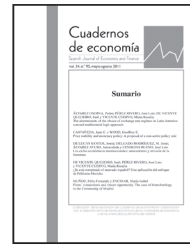

ARTÍCULO

European valuation multiples: the investors' sentiment about size

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KEYWORDS:
Valuation multiple; Market ratio; Size premium; Data panel; Mundlak model

Abstract: The aim of this paper is to bring a new perspective to the role of control factors in MARKET-EBITDA, MARKET-SALES and MARKET-BOOK ratios in the European market, which are different from industry. We analyze the role of size and its interactions with the rest of the variables: profitability, risk, and structural asset factors. For this purpose, we have developed a valuation model using panel data methodology for listed European firms from the period 2002-2013. We found that size includes economic aspects of the companies, but also differential investors' perceptions about these economic aspects. It is a complementary explanation factor on the selection of the peer group with the rest of the variables. These findings help to understand the variation of market ratios and share prices depending on size in different economic conditions or economic cycles. This research is in accordance with the theoretical framework of market ratios and with size effect theory.

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PALABRAS CLAVE:
Múltiplo de valoración; Ratio de mercado; Prima de tamaño; Datos de panel; Modelo de Mundlak

Resumen: El objetivo de este documento es aportar una nueva perspectiva sobre los factores de control, diferentes a sector o industria, necesarios para el correcto uso de los múltiplos de valoración: MARKET-EBITDA, MARKET-SALES y MARKET-BOOK en el mercado europeo. Analizamos el papel del tamaño y sus interacciones con el resto de las variables, en especial aquellas relativas a rentabilidad y riesgo. Se ha desarrollado un modelo de valoración basado en datos de panel para empresas cotizadas europeas durante el período 2002-2013. Descubrimos que el tamaño incluye aspectos económicos de las empresas, pero también capta otros aspectos diferenciadores, demostrando que los inversores pagan diferente en cada ratio la misma magnitud económica en función del tamaño de las empresas. Por todo ello el tamaño es un factor de control importante, junto al resto de variables, para seleccionar el grupo de comparación y averiguar si una empresa está cara o barata frente a otras. Lo descrito ayuda a comprender por qué las empresas grandes evolucionan de un modo diferente a comparación de otras más pequeñas ante las mismas condiciones económicas o ciclos. El artículo está en consonancia con el marco teórico de valoración por múltiplos, así como con la teoría del efecto tamaño.

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1. Introduction.

A valuation multiple is a ratio, normally the market value of a firm's assets divided by an economic magnitude of it. The objective of the multiples valuation is to assess a company by creating a benchmark, usually based on industry information. Analysts use average industrial multiples to identify mispriced shares or overvalued shares.

Schreiner and Spremann (2007) found that the multiples methodology is very intuitive. This methodology does not require detailed multi-year forecasting of free cash flows or projected residual incomes, as is the case of discounted cash flows (DCF approach). The value of the firm is instead associated with a peer group of companies considered to be comparable. A simple analysis of the stock prices of the firms in the peer group leads to a certain ratio which will be used as a multiplier of the target firm's value driver.

However, in line with Kaplan and Ruback (1995) and Baker and Ruback (1999), to understand the performance of multiples, it is important to interpret them as an application of a growing perpetuity of the cash flow valuation model. Though the multiples approach bypasses explicit projections and present value calculations, it relies on the same principles: value is a positive function of future payoffs and a negative function of risk. Therefore, multiples are often used as a substitute for exhaustive valuations, and they are also used to complement other comprehensive valuations, typically to calibrate those valuations and to obtain final values (Liu et al 2002).

Academic literature has evaluated multiples' performance on the choice of peer group and their ability to explain cross-sectional variations in stock prices, e.g., Alford (1992), Kim and Ritter (1999), Liu et al. (2002) (2007), Lie and Lie (2002), Bhojraj and Lee (2002) and Young and Zeng (2015), among others. In general, they agree on the necessity of adding economic variables to industry in selecting the multiples' peer group and they also found that using multiples valuation makes it possible to obtain a return.

Bhojraj and Lee (2002) have derived expressions for Price to Book ratio and Price to Sales ratio, and they developed an interesting cross section model for firms of the American merged COMPUSTAT database, for the period 1982-1998. They found that economic control factors are more important than size in the selection of the peer group, but they only compare the capacity prediction in selection of a peer group based on industry and economic factors against a selection based on industry controlled by size. In line with these authors we introduce the economic variables according to the corresponding analytical ratio's expression from the DCF-CAPM valuation approach, but unlike them, we focus on the size problem, so we introduce size separately from the rest of the control factors. We analyze the relationships with the rest of the economic variables to understand its role in *MARKET-EBITDA*, *MARKET-SALES* and *MARKET-BOOK* ratios, using a database of European listed firms obtained from the AMADEUS database in the most recent period: 2002-2013, across panel data methodology.

The paper finds that size is reduced when introducing the rest of the economic control factors, but it does not disappear, and comes up with important interactions between size and the rest of the economic variables, capturing the investors' perceptions toward Size, which help to explain the different cross-section variation in each multiple for the analysed period.

This paper is organised as follows: after the Introduction, in the second section, we review the previous literature on pricing by multiples and the efficiency theory, as well as proposing the hypothesis to contrast. In the third section, we deal with data collection and the model's explanation. In the fourth section, we present the results obtained from the estimation of the proposed model using panel data methodology. The article ends with the conclusions and final remarks.

2. Previous literature and hypothesis

2.1. Motivation and theoretical framework: pricing by multiples, efficiency theory and investors' sentiment.

The valuation of a company depends on its economic fundamentals, and therefore, there must be a relationship between market ratios and these fundamentals, which is also a consequence of the DCF-CAPM method[1]. For example, Ohlson (1990) expresses a firm's price-earnings multiple as a function of the expected growth rate of earnings, the expected dividend (pay out rate), the risk-free discount rate, and a risk-adjusted one. Kaplan and Ruback (1995) establish that a DCF-CAPM valuation approach in leveraged transactions has approximately the same valuation as one based on the ratio of earnings before interest, taxes, amortization and depreciation (EBITDA).

Previous articles have focused multiples valuation research on the selection of a peer group, establishing that firms in the same industry are expected to have similar levels of risk and earnings growth rate, although it is also usual to control the market ratios valuation with complementary variables. LeClair (1990) tests the price-earnings ratio with comparable firms selected by industry using three measures of earnings: current period earnings, average earnings over two years, and earnings attributable to tangible and intangible assets. The author concludes that average earnings perform best. Alford (1992) studied the success of pricing by the median price-earnings multiple in different industries for a group of companies, and he found that industry is a powerful criterion in the selection of companies, at least in the three-digit SIC classification[2]. He measured the accuracy of selecting comparable firms as the difference between the predicted and real price, and found that risk and the growth rate of profits do not improve the efficacy of the price-earnings ratio. The tests also indicated that valuation accuracy increases in firm size, and decreases with leverage.

Kim and Ritter (1999) use a regression model in which the firm price of the IPO (initial public offering of stock by a private company) depends on the geometric mean of price-earnings, price-book, and price-sales of a comparable group of firms. They concluded that within an industry, the variation in these ratios is so large that they have only modest predictive value. Therefore, many factors are not captured by industry multiples unless various adjustments for differences in growth rate, leverage and profitability are introduced. Finally, they argue that the price-earnings ratio is better than other ratios.

Baker and Ruback (1999) tested a model where the value of the firms also depends on a selection of average multiples in an industry, but the difficulty in estimating the value directly is that the valuation errors of the regression model are unlikely to be independent of value[3] involving heteroscedasticity (firms with higher values are likely to have larger errors). They demonstrated that multiples based on the harmonic averages are guaranteed to have minimum variance in small samples, and improve predictive capacity.

Cheng and McNamara (2000) evaluated the accuracy of price-earnings (P/E), price-book (P/B) and combined price-earnings and price-book ratios. The comparable firm group is based on industry, size and ROE (return on equity). They found that for P/E and P/B benchmark valuation methods the best definition of the comparable firms is based on industry combined with ROE.

Lie and Lie (2002) found that the price-book multiple generates more precise and less biased estimates than the price-sales and the earnings multiples do. However, adjusting for companies' cash levels does not improve estimates of company value. Finally, the accuracy and bias of value estimated vary 'very greatly' by firm size, profitability, and the intangible value.

Liu et al. (2002 and 2007) found that multiples based on future profits explain share prices better than multiples based on a variety of reported operating cash flows. Cash flow measures and book value of equity are tied with respect to earnings. However, Stauropoulos et al (2011, 2012) determined that Current earnings are identified as more appropriate value driver for the calculation of the P/E ratio than forecasted earning, in terms of accuracy.

Bhojraj and Lee (2002) found sharp improvements of multiples valuation by selecting the peer group based on different economic and financial characteristics, obtaining the so-called "warranted multiple" for sales ratio and price-book ratio: the sector (the harmonic mean of the corresponding industry ratio), the difference between growth rate of profit and profit margin of each firm with respect to its sector, leverage, ROA (return on assets), ROE and research and development expenditures. They compare the prediction capacity of the "warranted multiple" to another *selection* based on size after controlling for industry and they affirm that *"variables related to firm-specific profitability, forecasted growth rate and risk are more important than industry membership and firm size in explaining a firm's future sales and Price-Book value ratios"*.

The "warranted multiple" has been implemented in later works by Young and Zeng (2015) and Franco et al. (2015). The former uses the "warranted multiple" over a long period in European countries and found a temporal decline in valuation errors, coincided with convergence in accounting practice in Europe. Moreover, the peer selection based on mandatory IFRS (International Financial Reporting Standards) adoptions improves multiples' accuracy. The second one investigates the manner in which analysts choose peer companies by a probit-model implementation. Analysts choose peer firms similar in size, leverage, asset turnover, industry classification and trading volume, although the selection is not clear regarding other important variables such as profit margin, revenue growth rate or volatility of stock prices. It also found analysts select firms with high valuations, which helps explain the optimistic bias in stock recommendations.

Lee, Ma, and Wang (2015) compared the traditional industry classification methods with the searches of EDGAR users (EDGAR is an electronic data-gathering of the Security Exchange Commission, SEC), acquiring the financial information for benchmark firms. They found that these peer groups exhibit similarities that are not easily identified by other traditional benchmarking techniques (SIC, GICS codes). These internet searches collect investors' perceptions (subjective judgments), and perform better, explaining the ROE, financial variables and market valuation multiples. Nel and Roux (2015) also determined that a peer group of multiples, in emerging markets, based on a combination of economic variables, performs more accurate valuations than multiples whose peer group was selected on single valuation fundamentals or industry classifications.

In a comparison of target prices of DCF and P/E models applied to random samples of companies, Demirakos et al (2010) concluded that although analysts prefer DCF methodology, P/E improves comparatively the accuracy in the valuations. If the model is controlled by other variables the accuracy between the two models is very similar, because after controlling variables that capture the difficulty of the valuation task the performance of DCF models improves.

The relevance of market multiples in predicting share prices is clear, but so is the inability of industry to explain the performance and the accuracy of market ratios and the necessity of adding other economic control factors in the selection of the peer group. However, in previous literature there is not a consensus on the role of size, one of the most controversial control factors. Its effect in each ratio and its relationships to the rest of economic variables is the most important objective in this article.

We interpret the multiple as an application of a growing perpetuity of the cash flow valuation model (Ohlson, 1990; Kaplan and Ruback, 1995; Baker and Ruback, 1999) in which the required return is calculated from the WACC (Weighted Average Cost Of Capital)-CAPM (Capital Asset Pricing Model). In the WACC-CAPM model the efficient market is a fundamental concept. According to mainstream finance theory, the financial market should incorporate all the relevant information into pricing the assets (Fama 1970). The One-Factor CAPM model (Sharpe, 1964 and Lintner, 1965) defines the expected returns on securities as a positive linear function of the risk-free rate, the market risk premium, and their market betas.

Nevertheless, the existence of a size effect is in conflict with Efficient Market Theory, because it allows us to expect that return also depends on firm size, (Fama and French 1992, 1998)[4]. There is abundant literature about size effect: Banz (1981), the first author who studied this effect, found that small capitalisation firms had higher returns. Fama and French observed that CAPM Betas do not successfully explain the yields from small companies. They questioned whether the size effect causes premiums to compensate the systemic risk.

Barber and Lyon (1997) and Reingamun (1999) support the conclusions of Fama and French, and they found that size effect is an important element for the forecast of companies' returns, becoming in an important component of the risk. Probably, this is the consequence of different investors' sentiment in fundamental variables depending on Size. Investor's sentiment is investor's opinion, driven by subjective perceptions about future cash flows and investment risk, creating a challenge to the Efficient Market hypothesis (Brown & Cliff, 2004). CAPM assumes rational markets, and the decisions comply with the axiom of expected utility theory. However, following Shiller (2003), along with things like economic reports and global events, the market also is driven by sentiment, and this has consequences on prices allocation between low to high-risk firms.

Van Dijk (2011) summarises different positions about size effect and concludes: 1.Size effect is an indicator of the exposure of the company to fundamental variables which describe the temporary variation in the investment opportunity set. 2. The size premium is the compensation for trading costs and/or liquidity risk. 3. Size is an indicator of the non-rationality of valuation models.

Obviously, if size affects the expected and required return on prices, this market`s imperfection about size also could have a relevant performance in market ratios that had not been previously studied.

2.2. The hypothesis.

The DCF captures the company value drivers to project the main firms' economic and financial variables. All future cash flows are estimated and discounted by using an adequate required return by the financial structure (average cost of capital or WACC). Thus, the present value of cash flows determines a firm's assets structure. The reliability of DCF depends on accuracy in the calculation of these variables. There is a potential source of error as a consequence of spurious projected cash flows and risk measures (Kaplan and Ruback, 1995). To ensure impartiality in the model, it is necessary to compare the projected hypothesis with market multiples, which contain market expectation.

If we interpret the multiples market as a contrast methodology of the DCF-CAPM model, the variables that affect a growing perpetuity of the cash flow valuation model are also going to affect the multiples. For example, in the case of the *MARKET-EBITDA* multiple, the point of reference is the definition of free cash flow (FCF)[5] as earnings before interest and after taxes minus the necessity or variation in working capital (WC) and capital expenditures (CAPEX). Equations (1) and (2) represent this concept:

$$FCF = \left(EBITDA - Depreciation\right) x\left(1-t\right) + Depreciation - Variation\,of\,WC\,\&\,CAPEX \tag{1}$$

If t (tax rate) = 0

$$FCF = EBITDA - Variation\,of\,WC\,\&\,CAPEX \tag{2}$$

Equation (3) represents the DCF-CAPM model, which defines firm value (EV) as a function of FCF, the expected growth rate of it (gr), and the weighted average cost of capital (WACC)[6]:

$$EV = FCF\left(1+gr\right)/\left(WACC-gr\right) \tag{3}$$

Substituting (2) in (3), we obtained the analytical expression of the multiple:

$$\frac{EV}{EBITDA} = \frac{1+g}{WACC-g} * \left(1 - \left(\frac{Variation\,of\,WC\,\&\,CAPEX}{EBITDA}\right)\right) \tag{4}$$

In this line, we could obtain analytical expressions for *MARKET-SALES* and *MARKET-BOOK* multiples:

$$\frac{EV}{SALES} = \frac{1+g}{WACC-g} * \left(\frac{EBITDA - Variation\,of\,WC\,\&\,CAPEX}{SALES}\right) \tag{5}$$

$$\frac{EV}{BV} = \frac{1+g}{WACC-g} * \left(\frac{EBITDA - Variation\,of\,WC\,\&\,CAPEX}{ASSETS}\right) \tag{6}$$

According to equations (4), (5) and (6), these multiples are a function of "g", the growth rate of EBITDA, the "WACC" or required return, and the necessities to invest in asset structure (WC and CAPEX) divided by EBITDA, sales or assets, depending on the ratio considered. In the case of the *MARKET-SALES* ratio, it also depends on the profit margin: EBITDA between sales, and in the *MARKET-BOOK* ratio, it is also a function of a type of return on assets: EBITDA divided by assets.

In our model, then, according to the theoretical framework and previous equations, we aim to observe and conclude the following hypotheses:

Industry could capture future growth rate capabilities, as well as different perceptions of risk (Alford, 1992). However Alford himself, Cheng and Mcnamara (2000) and Lie and Lie (2002) also indicated that accuracy changes with size. Hope and Larocque (2015) found that analysts choose the peer group based on similar size. We therefore check in hypothesis one whether it is possible that size explains other attributes not captured by industry and for this reason it has an impact on ratios' accuracy. We also have introduced country variables to capture the possible effects due to the allocation for each firm in its corresponding country, as well as cyclical effects using year variables.

H1. *Market ratios in Europe are different by industry, one time controlled by country and year. Nevertheless, there is also a relationship between market ratios and size.*

Additionally, Kim and Ritter (1999) concluded that the necessary factors not captured by industry multiples are growth rate and profitability. Cheng and Mcnamara (2000) found that the best comparable firm definition is based on industry combined with ROE. Lie and Lie (2002) established that the accuracy and bias of value estimates vary greatly by company size, profitability, and intangible value of the firm. Bhojraj and Lee (2002), Young and Zeng (2015) and Nel and Roux (2015) also found noticeable improvements of multiples valuation by selecting the peer group based on different economic and financial characteristics.

In fact, in equations (4), (5) and (6), we can see, in line with Bhojraj and Lee (2002) and the previous authors, that there is a positive relationship with "expected growth profitability", g, and a negative one with the required return or WACC, a consequence of the discount required by capital. Finally, in the equations above, we can also observe a negative relationship between valuation ratios, leverage and structural asset ratios: WC and CAPEX. The *MARKET-SALES* ratio and the *MARKET-BOOK* ratio depend also respectively on the profit margin and return on assets. Then, our second hypothesis is:

H2. *Size is not enough to capture profitability and risk not included in industry and we expect:*

H2.1. *There is a positive relationship between market ratios and profitability variables.*

H2.2. *At the same time the ratios depend negatively on risk variables.*

The problem of size has been widely studied as an anomaly of market efficiency (Banz, 1981; Fama and French, 1970, 1992, 1998). Van Dijk (2011) summarises the position regarding the size premium, and the key question in hypothesis 3 is whether size represents investors' perceptions about fundamental variables, describing the temporary variation in the investment opportunity, thus:

H3. *The different relationships between size, profitability and risk variables could explain size.*

3. Data collection and model.

The firms' data have been obtained from the AMADEUS database. We have selected non-financial listed European companies from the period 2002-2013. We initially had an average of 4,032 firms. We have removed the observations with values missing from any of the variables and also the negative value multiples, because it is not possible to use them as a measuring tool. We have also lost three years (2002, 2003 and 2004) to calculate the growth rates and the standard deviation of the growth rate of prices. Finally, in line with Officer (2007) or Liu et al. (2007) we have eliminated the outliers corresponding to 5% of the lower and upper limits of the three ratios. We have also checked the presence of outliers, using Bacon command in Stata (Weber, 2010), based in Mahalobis distance, excluding the observations with biggest distances. However, we obtained that models' results were very similar.

Baker and Ruback (1999) demonstrated that the harmonic averages are guaranteed to solve heteroscedasticity problems, while Chullen et al (2015) found that the geometric mean is a better measure of central tendency in ratios analysis than the usual sample mean or the harmonic mean, because this provides highest valuation accuracy, mean 0, and the lowest median log-scaled errors, as well the lowest volatilities. In this form, a log-linear regression is also applied in value-relevance of financial statement information due to its flexibility in accommodating non-linear relationships, outliers and heteroscedasticity problems (Hand 2005; Elnathan et al.2010; Rubio-Martin et al 2013).

In line with these authors we have transformed each continuous variable into its natural logarithm and afterwards we checked that there are no appreciable changes in our results incorporating harmonic averages. We have decided present previous form in which results are easier to be interpreted.

On the other hand, we are looking for evidence that profitability and risk variables differ across size groups. So, in line with Fama and French (2012), *Size* is transformed into a categorical dummy variable. We have created *Size* with xtile command in Stata, creating four quartiles, approximately with equal number of observations, for each moment in time[7].

We obtain an unbalanced panel with 13,054 observations with information about 3,070 firms. The average number of years that a firm was observed is 5, and the average number of firms per year is 2,714. In table 1, we present the main descriptive statistics of the sample.

Table1. Main descriptive statistics

This table provides information on the mean, medium and standard deviation of basic variables for the regression model. EV, computed as market value plus financial debt. *MARKET-EBITDA* is EV between EBITDA. R. *Leverage* is debt divided by equity; *Work cap*, the percentage of current assets between total assets at book value; *Intang*, the percentage of intangible assets between total investment capital at book value; $Profit_m$, percentage of EBITDA compared to total sales, and ROA_m,. percentage of EBITDA compared to total assets.

	Mean	Medium	Std. Dev.
EV	2,562,679	172,348	10,300,000
EBITDA (mil EUR)	381,182	22,421	1,879,789
SALES (mil EUR)	2,467,695	205,597	11,400,000
ASSETS (mil EUR)	3,293,207	219,996	15,600,000
R. MARKET/EBITDA	9.21	7.60	6.38
R. MARKET/SALES	1.37	0.84	1.88
R. MARKET/BOOK	1.40	1.16	0.86
R. Leverage	1.38	0.67	8.86
Work cap	0.31	0.27	0.22
Intang	0.25	0.18	0.24
ROA_m	0.18	0.16	0.10
$Profit_m$	0.15	0.12	0.12
SGP	0.34	0.28	0.31
GR (YES/NO)	0.50	1.00	0.50
GR	0.13	0.05	15.27
Size	2.52	3.00	1.10

Total. obs. 13.054

Source: AMADEUS (Bureau van Dijk) and own elaboration

Table 2. Dicotomicus variables.

Size	%
1	23.11
2	26.51
3	25.95
4	24.43
Total	100

GR value	%
Yes	49.81
No	50.19
Total	100

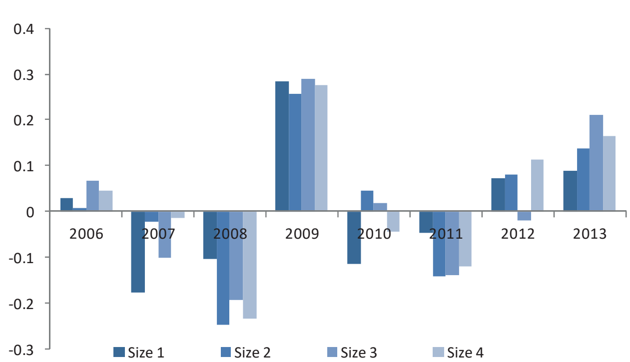
With regard to table 3 the ANOVA test shows that the means of *MARKET-EBITDA* between groups are statistically significant for each year (a similar conclusion could be done for the *MARKET-SALES* and *MARKET-BOOK* ratios). Furthermore, we can check back to the last debt crisis, in 2005. The smallest companies' ratio was bigger than the largest ones, but at the end of the crisis, in 2013, it is an opposite situation. The mean ratio of the largest companies is bigger. In fact, regarding figure 1 we observe a different ratio performance depending on size and year. For example in 2007 and 2010 the smallest companies (level one) decreased more than the largest one (level four), while in 2013 enterprises from levels three and four, comparatively grew more.

Table 3. The behaviour of ratios across size classes: Anova test, comparison of means, *MARKET-EBITDA* ratio.

This table tests the hypothesis that the means of market ratios are equal by different levels of size throughout years. The null hypothesis states that all means are equal.
*Prob<= 0.01**** implies rejecting null hypothesis.

Size		2005	2006	2007	2008	2009	2010	2011	2012	2013
Prob > F		***	***	***	***	***	***	***	***	***
	1	9.95	10.23	8.423	7.549	9.682	8.586	8.192	8.794	9.572
	2	9.828	9.915	9.689	7.306	9.173	9.602	8.231	8.886	10.1
	3	10.03	10.71	9.63	7.763	10.01	10.2	8.797	8.632	10.44
	4	9.367	9.781	9.652	7.388	9.416	9.01	7.931	8.838	10.3
	1		0.028	-0.18	-0.1	0.283	-0.11	-0.05	0.073	0.089
	2	%	0.009	-0.02	-0.25	0.256	0.047	-0.14	0.08	0.137
	3		0.068	-0.1	-0.19	0.289	0.019	-0.14	-0.02	0.21
	4		0.044	-0.01	-0.23	0.275	-0.04	-0.12	0.114	0.165

Figure 1. *MARKET-EBITDAs*' variation throughout years and size levels



In the following paragraphs, we study this phenomenon from an econometric point of view. In our model, we directly introduce the market multiple ratio as a dependent variable: the *MARKET-EBITDA*, *MARKET-SALES* and *MARKET-BOOK* multiples, and the independent variables are the firm's structural and economic features which affect them (equations 4, 5 and 6). It is important to stress that EV is always divided by magnitudes associated with firm size, and this fact eliminates a possible spurious relationship due to the scale (Gu, 2005; Barth and Clinch, 2009).

First, to contrast hypothesis 1, we propose the following expression where *Industry, Year, Country* and *Size* variables have been evaluated.

$$M.Ratio_{it} = \alpha + \beta_{1i}Size_{it} + \beta_{2i}Year_{it} + \beta_{3i}Industry_{it} + \beta_{4i}Country_{it} + \varepsilon_{it} \quad (7);$$

where:

M. Ratio, market ratio, is a generic nomenclature referring collectively to the *MARKET-EBITDA*, *MARKET-BOOK* or *MARKET-SALES* ratio. *MARKET-EBITDA* is calculated as the ratio of firm value, which is obtained by summing up market capitalisation and financial liability at book value, by EBITDA. *MARKET-SALES* is the ratio obtained by dividing firms' value and the sales obtained for each company. *MARKET-BOOK* is the ratio of the firm value divided by the net book value of the asset. The net book value of the asset, or investment capital, is equal to the sum of net noncurrent assets plus the working capital of the firms at book value. *Size* is the market capitalisation of each firm. *Year* is a set of dummies of temporal control variables, and *Industry* and *Country* are a set of dummies involving the allocation for each firm in the country and the industry (the 17 industries based on the primary code of NACE, rev. 2. Statistical classification of economic activities in the European Community). The sample composition in terms of firms by countries and industries is also presented in tables A.1, A.2 and A.3 in the annex.

Secondly, to contrast hypothesis 2, we have introduced independent variables that capture **profitability, risk** and **asset structure** in specification (8):

$$M.Ratio_{it} = \alpha + \beta_{1i}Size_{it} + \beta_{2i}GR_{it} + \beta_{3i}SGP_{it} + \beta_{4i}Year_{t} + \beta_{5i}\,Lever_{it} + \beta_{6i}WC_{it} + \beta_{7i}\,\mathrm{Intang}_{it} + \beta_{8i}Industry_{it} + \beta_{9i}Country_{it} + \varepsilon_{it} \quad (8)$$

Growth *(GR)* is the percentage of EBITDA's growth: the EBITDA's growth rate has been calculated over the current and previous year. We have transformed, in line with Elnathan et al. (2010), positive values in the logarithm of the values plus a maximum amount (the highest of negative values plus 1): ln (GR+max), and negative growths in –ln(-GR+max). The Required return variable *(SGP)* is calculated as the standard deviation of prices growth rate (calculated over every firm and from every year of the current and the two previous years). CAPM-Beta ignores the existence of a size problem; so we introduce, in line with Bajaj et al (2001), the volatility of growth prices as a measure of required return. Furthermore, models to estimate conditional volatilities, such as GARCH (Bollerslev 1986), evidence a relationship between past, current, and future volatilities.

Lever, is measured as the relationship of the book value financial liabilities divided by own resources or equity, the latter in terms of market prices. Finally, in regards to structural asset ratios, *WC* is the weight of working capital (current assets minus current liabilities, non-financial liabilities at book value) with respect to total investment. *Intang* is the proportion of intangible assets over total assets at book value. Following equations (5) and (6), we have introduced the variables $Profit_{marg}$ (EBITDA divided by sales) and ROA_m (EBITDA divided by assets at book value) for the *MARKET-SALES multiple* and the *MARKET-BOOK multiple,* respectively in (8).

To contrast hypothesis 3, we have analysed the **interaction** between **size**, **profitability** and **risk** factors in equation (9), as well as the interactions with $\text{Profit}_{\text{marg}}$ and ROA_{m} depending on the ratio.

$$\begin{aligned} M.Ratio_{it} &= \alpha + \beta_{1i}Size_{it} + \beta_{2i}GR + \beta_{3i}SGP_{it} + \beta_{4i}Year_t \\ &+ \beta_{5i}\,Lever_{it} + \beta_{6i}WC_{it} + \beta_{7i}\text{Intang}_{\text{it}} + \beta_{8i}Industry_{it} \\ &+ \beta_{9i}Country_{it} + \beta_{10i}Size_{it} * GR_{it} + \beta_{11i}Size_{it} * SGP_{it} \\ &+ \beta_{12i}Size_{it} * Lever_{it} + \varepsilon_{it} \end{aligned} \tag{9}$$

We have estimated expressions (7) to (9) using a hybrid-effects GLS regression. First, we have used the Breuch-Pagan Lagrangian multiplier test to guarantee the convenience of random effects over pool data. Nevertheless this method assumes that the individual-specific error in the model is a random variable that is uncorrelated with the explanatory variables. Allison (2009), based on Mundlak (1978), proposes a way to relax this assumption, adding in a random effect estimation by group-means of variables as independent variables. It is called the "hybrid model" [8].

This procedure overcomes the burdens of two basic assumptions of the OLS regression: the autocorrelation among repeated observations over years for every individual, and the heteroscedasticity problem, a consequence of omitted variables. The hybrid model also allows us to check the behaviour of time-invariant variables, country and industry dummies that control structural characteristics, also controlling cyclical behaviour by year dummies. To solve other problems derived from heteroscedasticity and serial correlation, the asymptotic variance of errors has been consistently estimated with the so-called cluster-robust covariance estimator[9].

4. Results.

In table 4, we present the results of equation (7) for each multiple or market ratio. There important differences can be observed by *Industry*, meaning that each of them captures structural differences and capabilities to create value in the companies. We found less value in the *MARKET-EBITDA* or in the *MARKET-SALES* ratios for Manufacturing Industry; Construction; Wholesale & Retail Trade or Repair of Vehicles. These are traditional activities, and probably present limited capacity for future growth rate. Therefore, using multiples in order to compare a company with a benchmark in Europe, it has to be divided by industries.

(See Table 4).

With regard to *Country*, we also obtained different behaviour depending on the multiple. In the *MARKET-BOOK* we found that, in general, peripheral countries have a lower value than central countries: the ratio presents positive differences for the United Kingdom, Finland and Sweden, while presenting negative differences in comparison with the intercept for peripheral countries: Croatia, Slovenia, Greece, Italy, Portugal and Romania [10].

Despite the differences found across industries and countries, in the *MARKET-EBITDA* ratio and *MARKET-SALES* ratio, testing the joint significance of every set of the *Industry* and *Country* dummies using a parametric test, we found that the country dummies are not significant while the industry ones are.

Otherwise, the *Size* variable is also significant in the three multiples, albeit with remarkable differences between them. The *MARKET-EBITDA* size premiums, in relation to the first quartile, are 15%[11] in the case of the second quartile, 35% for the third quartile and 50% for bigger firms, whereas in the other ratios they are much higher. In the case of the *MARKET-SALES* ratio, we obtained 40%, 77% and 115%, respectively, and in the *MARKET-BOOK* ratio, 38%, 76% and 110%, respectively. It is clear that *Industry* is not enough to capture firms' future capabilities in each ratio, which confirms *hypothesis 1.*

Moreover, in relation to the economic cycle, we can appreciate a drop in the value of the three ratios between the worst year, 2008, and the best year, 2006. For example, in the *MARKET-EBITDA* ratio, the fall is about 33% over the intercept (year 2005), and we also observe a slight recovery for 2009-2010, but in 2011 there is again a pronounced decline of 23%, which is partly recovered during the remaining period 2012-1013. This behaviour matches the evolution of the last European financial crisis, and it indicates that it is necessary to consider the economic cycle in the use of ratios.

To contrast *hypothesis 2*, while evaluating the persistence of *Size* in valuation multiples, we have introduced the rest of the variables of equation (8), which represents important value drivers, namely, profitability, risk variables and those relative to the structural assets ratios: working capital and intangible factors.

The use of different variables of size, profitability and risk in the same equation also requires control of the correlations between them and testing for collinearity[12]. In table 5, we can appreciate the absence of this problem; it is also important to stress that the Pearson correlation of *Size* and the volatility of growth prices, as well as *Size* and the growth of the *EBITDA* are always negative. Smaller companies have more risk, but are also more profitable than larger ones, according to size theory.

Table 4. Estimation of equation (7). Hybrid Model.

This table, following hypothesis I, reports the results of data panel for each market ratio using all possible peers from the same on *Size*, *Year*, *Industry*, NACE 2-digit industry, and *Country*. Intercepts are included. They represent the value of each ratio for the first level of each ordinal variable: the average value for country 1, Germany, Industry 1, agriculture, forestry and fishing, size of firm one, and year 2005. The rest of the levels indicate the necessary amount to add over the intercept to obtain the new value of the ratio.

		R.M-EBITDA	R.M-SALES	R.M-BOOK
Size. (Quartiles)	2	0.15 ***	0.40 ***	0.38 ***
	3	0.35 ***	0.77 ***	0.76 ***
	4	0.50 ***	1.15 ***	1.10 ***
Year.	2006	0.03 **	0.03 ***	0.05 ***
	2007	-0.06 ***	-0.03 ***	-0.04 ***
	2008	-0.33 ***	-0.36 ***	-0.38 ***
	2009	-0.06 ***	-0.19 ***	-0.29 ***
	2010	-0.09 ***	-0.16 ***	-0.24 ***
	2011	-0.23 ***	-0.30 ***	-0.36 ***
	2012	-0.14 ***	-0.27 ***	-0.33 ***
	2013	0.00	-0.17 ***	-0.23 ***
Industry.	2. Mining and quarrying	-0.15	0.07	0.16 **
	3. Manufacturing industry	-0.14 ***	-0.54 ***	0.20 ***
	4. Supply of electricity, gas, steam and air conditioning	-0.12	-0.04	-0.08
	5. Water supply, sanitation activities, waste management	-0.10	-0.07	0.26 ***
	6. Construction	-0.14 ***	-0.94 ***	0.01
	7. Wholesale and retail trade; repair of motor vehicles	-0.15	-0.89 ***	0.24 ***
	8. Transport and storage	-0.07	-0.21	0.09
	9. Hospitality	0.31 **	0.30	0.13
	10. Information and communication	0.02	-0.17	0.51 ***
	11. Real estate activities	0.67 ***	1.16 ***	0.01
	12. Professional, scientific and technical activities	0.04	-0.33	0.47 ***
	13. Administrative and support service activities	-0.19	-0.81 ***	0.44 ***
	14. Education	-0.03	-0.35	0.55 ***
	15. Health activities and social services	0.21	-0.19	0.48 ***
	16. Artistic, recreational and entertainment activities	-0.02	0.02	0.43 ***
	17. Other services	0.60 ***	1.26 ***	-0.01
Country.	2. Austria	-0.07	-0.07	-0.03
	3. Belgium	-0.02	0.06	-0.01
	4. Bulgaria	0.08	0.35 ***	-0.01
	5. Cyprus	0.04	0.25	-0.06
	6. Croatia	-0.11 ***	0.21 **	-0.21 ***
	7. Denmark	0.02	0.13	0.09
	8. Slovakia and Slovenia	-0.16	0.15	-0.44 ***
	9. Spain	0.19 **	0.43 ***	0.10 **
	10. Estonia	0.06	0.19	0.16 ***
	11. Finland	0.15	0.02	0.14 ***
	12. France	-0.03	0.08	0.07 ***
	13. Greece	0.04	0.26 ***	-0.27 ***
	14. Hungary	-0.13	-0.11	0.12
	15. Ireland	0.20	0.23 **	0.11
	16. Italy	-0.05	0.06	-0.13 ***
	17. Latvia	-0.26 ***	0.02	-0.27 ***
	18. Lithuania	-0.31 ***	-0.01	-0.02
	19. Luxembourg	-0.10	0.12	-0.13
	20. Malta	0.00	0.56 ***	0.12
	21. Netherlands	-0.01	0.00	0.04
	22. Poland	0.00	0.06	0.02
	23. Portugal	-0.06	0.15	-0.25 ***
	24. United Kingdom	0.06	0.29 ***	0.12 ***
	25. Czech Rep.	0.15	0.98 ***	-0.02
	26. Romania	-0.32	0.14	-0.06
	27. Sweden	0.10	0.15 ***	0.26 ***
Intercep		2.36 ***	0.22 ***	0.18 ***
	Prob<= 0.01 ***	Nº Observ= 13,054	Nº Observ= 13,054	Nº Observ= 13,054
	Prob <= 0.05 **	Rho=0.54	Rho=0.84	Rho=0.75
	Prob<= 0.10 *	Wald chi2(54)= 1905.45	Wald chi2(54)= 4483.10	Wald chi2(54)=5400.79
		Prob > chi2 = 0.0000	Prob > chi2 = 0.0000	Prob > chi2 = 0.0000
		Sector.Chi2=122.63 Country.Chi2=0.08	Sector.Chi2=123 Country.Chi2=2.64	Sector.Chi2=33.98 Country.Chi2=79.12
		Prob>chi2 = 0.00 Prob>chi2 = 0.7731	Prob>chi2 = 0.00 Prob>chi2 = 0.11	Prob>chi2 = 0.00 Prob>chi2 = 0.00

Table 5. Correlation Matrix.

This table provides the correlation between the dependent and independent variables in the data panel model, reflecting the Pearson correlation.

	R.M/EBITDA	R.M/SALES	R.M/BOOK	ROA_m	$Profit_m$	Size	GR	SGP	Year	Leverage	Cod.Sector	Cod.Pais	Working cap	Intang
R.M/EBITDA	1													
R.M/SALES	0.5261	1												
R.M/BOOK	0.3642	0.4187	1											
ROA_m	-0.5396	-0.0786	0.5876	1										
$Profit_m$	-0.1207	0.7807	0.2212	0.3048	1									
Size	0.0864	0.3075	0.2557	0.1561	0.2955	1								
GR	0.1374	-0.0823	-0.1856	-0.2872	-0.1971	-0.1527	1							
SGP	-0.0857	-0.0666	-0.0105	0.065	-0.0147	-0.0238	0.0011	1						
Year	-0.0154	-0.0279	-0.1285	-0.1027	-0.0212	-0.031	0.0284	-0.127	1					
Leverage	-0.2623	-0.4646	-0.6025	-0.3167	-0.3495	-0.1148	0.1032	0.0645	0.0292	1				
CodSector	0.1939	0.1627	0.1427	-0.0394	0.0474	-0.1104	-0.014	-0.0245	0.0236	-0.0502	1			
Cod.Pais	0.037	0.0535	0.0996	0.0579	0.0352	0.0138	-0.0019	0.1153	0.0333	-0.0907	0.0654	1		
Working cap	0.0073	-0.1547	0.1518	0.1308	-0.186	-0.226	0.0373	0.0412	-0.018	-0.2287	-0.0744	-0.043	1	
Intang	-0.0609	-0.1604	0.1882	0.2231	-0.1425	0.1382	-0.0696	0.0111	0.0412	-0.0217	0.0534	0.1221	-0.0922	1

The results of the estimation of expression (8) are presented in table 6[13]. In this table, we can observe that profitability variable, *GR*, has a positive impact on the *EBITDA* and *MARKET-SALES* ratios, while risk variables, *SGP* and the *leverage* ratio, have a negative impact on the corresponding multiples' values.

Working capital also has a negative impact on the *MARKET-EBITDA*, *MARKET-SALES* and *MARKET-BOOK* ratios. This result can be interpreted in the sense that the firm which needs more working capital in an organic growth phase needs a higher level of investment, and then it will reduce the EV in comparison with others that have a lesser working capital structure. *Intang* does not have any impact on the *MARKET-EBITDA* and *MARKET-SALES* ratios, but it could be because the intangible accounting measures are not adequate, nor are their effects on firms. As such, these results have to be treated with caution.

Finally, $Profit_{marg}$, and ROA_m are important control factors in the corresponding ratios: *MARKET-SALES* and *MARKET-BOOK* ratios, respectively (the Pearson coefficients of each variable with their respective ratios in the matrix correlation, table 6, are also high). Both coefficients are positive and statistically significant.

We observe, to sum up, that the ratios would go up when investors expect a positive growth rate, *GR*, or a rise in other profitability variables: $Profit_{marg}$, and ROA_m, while they fall when the volatility of required return, *SGP* or *leverage* increase, confirming *hypothesis 2*. This phenomenon, at the same time, has an influence on the size premium. In fact, we observe in table 7 how the *Size* was down in the *MARKET-EBITDA* ratio; now it is 6%, 17% and 24% for the second, third and fourth quartiles, respectively. In the *MARKET-BOOK* ratio and *MARKET-SALES* ratio we observe a similar process, but size premium continues comparatively higher.

Table 6. Estimation of equation (8): Hybrid Model.

This table, following hypothesis and sub-hypothesis II, reports the results of estimating data panel model incorporating new variables in continuous time from profitability and risk factors. Profitability: *GR*, the EBITDA growth rate; $Profit_m$, percentage of EBITDA compared to total sales, and ROA_m, percentage of EBITDA compared to total assets. For their part, risk variables are *SGP*, calculated as the standard deviation of prices growth rate and *Leverage*: debt divided by equity. Also we have included as asset ratios: *Work cap* and *Intang*, percentages of current and intangible assets between investment capital at book value respectively. In all estimations a set of dummies for country and industry are included through a parametric test.

		R.M-EBITDA	R.M-SALES	R.M-BOOK
Size (Quartiles)	2	0.06 ***	0.16 ***	0.14 ***
	3	0.17 ***	0.32 ***	0.28 ***
	4	0.24 ***	0.46 ***	0.40 ***
GR		0.04 ***	0.01 ***	0.004 ***
SGP		-0.03 ***	-0.01 ***	-0.01 ***
Year	2006	0.05 ***	0.03 ***	0.03 ***
	2007	-0.01	0.01	-0.02 **
	2008	-0.22 ***	-0.17 ***	-0.20 ***
	2009	0.01	-0.05 ***	-0.15 ***
	2010	-0.03 ***	-0.05 ***	-0.13 ***
	2011	-0.14 ***	-0.15 ***	-0.20 ***
	2012	-0.06 ***	-0.12 ***	-0.18 ***
	2013	0.05 ***	-0.05 ***	-0.10 ***
Leverage		-0.15 ***	-0.31 ***	-0.32 ***
Work cap		-0.03 ***	-0.01 **	-0.02 ***
Intang		0.00	0.00	0.01 **
$Profit_m/ROA_m$			0.19 ***	0.18 ***
Intercep		2.27 ***	1.69 ***	1.02 ***
Prob<=0.01 ***		Nº Observ= 13,054	Nº Observ= 13,054	Nº Observ= 13,054
Prob <= 0.05 **		Rho=0.52	Rho=0.71	Rho=0.71
Prob<= 0.10 *		Wald chi2(64) = 2384.71	Wald chi2(86) =14965.7	Wald chi2(66) =9659.87
		Sector. Chi2=127.54 Country. Chi2=0.10	Sector. Chi2=221 Country. Chi2=0	Sector. Chi2=175.74 Country. Chi2=0.22
		Prob>chi2 = 0.00 Prob>chi2 = 0.75	Prob>chi2 = 0.00 Prob>chi2 = 0.97	Prob>chi2 = 0.00 Prob>chi2 = 0.64

In table 7, we present the results of the estimation of expression 9, which includes the interaction of profitability and risk variables with *Size* (*hypothesis 3)*. As a result of this inclusion, the individual effect of *Size* on the *market ratios* is strongly reduced or even eliminated, and then the cross-effect with growth and risk variables emerges. The variable *GR* has a negative impact when the size class increases in *MARKET-EBITDA and* in *MARKET-SALES*, but it is also remarkable that the interaction of *Size* with *SGP* shows a positive effect for the largest size classes (three and four). Therefore, in a selection of the peer group based on *GR* and *SGP*, for the same *GR* it is necessary to take into account that investors pay more in small sizes and, for the same *SGP*, pay more for the largest sizes, although in *MARKET-BOOK* this effect is less intense.

For its part, the interaction of *leverage* and *Size* has an important effect: larger companies have less value at the same level of borrowing than smaller companies in the three ratios. Finally we also observe the stronger and negative interaction of $Profit_{marg}$ with *Size* in *MARKET-SALES*. Therefore, we found in table 7 that, depending on the ratio, the different relationship between size, profitability, growth rate and risk tends to explain *Size* and reduce its individual effect (*hypothesis 3)*.

On the other hand, to verify the importance of each explanatory variable on the variation of each market ratio we examine the matrix of partial and semi-partial correlations (Table 8). We can observe in the specific portion of the market ratios' variance explained by each variable, that *Size* is always relevant for each ratio. It is even so in semi-partial correlations, after we consider the effects of the rest of the independent variables on the dependent variable. In this form there is no doubt that *Size* has to be considered in the selection of a peer group along with the rest of the control factors.

Table 7. Estimation of equation (9): interactions of size with profitability and risk factors. Hybrid model.

This table, following hypothesis III, reports the results of the estimating data panel model, identifying the part of Size explained as a consequence of the interactions between Size and profitability (GR, $Profit_m$, ROA_m) and risk variables (SGP and Leverage). In all estimations a set of dummies for country and industry is included via a parametric test.

		R.M-EBITDA	R.M-SALES	R.M-BOOK
Size (Quartiles)	2	0.00	0.18 ***	0.10 ***
	3	0.01	0.17 ***	0.20 ***
	4	0.07	0.20 ***	0.39 ***
GR		0.06 ***	0.01 ***	0.01 **
SGP		-0.05 ***	-0.02 ***	0.00
Year	2006	0.05 ***	0.03 ***	0.02 ***
Year	2007	-0.01	0.01	-0.02 **
Year	2008	-0.21 ***	-0.17 ***	-0.19 ***
Year	2009	0.01	-0.06 ***	-0.15 ***
Year	2010	-0.03 ***	-0.05 ***	-0.13 ***
Year	2011	-0.15 ***	-0.15 ***	-0.20 ***
Year	2012	-0.06 ***	-0.12 ***	-0.18 ***
Year	2013	0.05 ***	-0.05 ***	-0.10 ***
Leverage		-0.12 ***	-0.26 ***	-0.25 ***
Working cap		-0.02 ***	-0.01 **	-0.02 ***
Intang		0.00	0.00	0.01 **
$Profit_m/ROA_m$			0.20 ***	0.17 ***
Size**GR (Quartiles)	2	-0.01	0.00	0.00
	3	-0.03 ***	-0.01 ***	-0.01 ***
	4	-0.03 ***	-0.01 ***	0.00
Size**SGP (Quartiles)	2	0.02	0.01	0.01
	3	0.04 ***	0.02 **	0.02 **
	4	0.04 ***	0.01 *	0.01
Size**Leverage (Quartiles)	2	-0.03 ***	-0.05 ***	-0.07 ***
	3	-0.05 ***	-0.07 ***	-0.10 ***
	4	-0.05 ***	-0.10 ***	-0.14 ***
Size** $Profit_m/ROA_m$	2		0.02	-0.01
	3		-0.03	-0.01
	4		-0.08 ***	0.04 **
Intercep		2.21 ***	1.31 ***	0.94 ***
Prob<= 0.01 ***		Nº Observ= 13,054	Nº Observ= 13,054	Nº Observ= 13,054
Prob <= 0.05 **		Rho=0.52	Rho=0,71	Rho=0,71
Prob<= 0.10 *		Wald chi2(76)=2,645.08	Wald chi2(96) =16,307	Wald chi2(96) =12,442.65
		Prob > chi2 = 0.0000	Prob > chi2 = 0.0000	Prob > chi2 = 0.0000
		Sector. Chi2=128.77 Country. Chi2=0.12	Sector. Chi2=125.41 Country. Chi2=1.17	Sector. Chi2=177.92 Country. Chi2=0.22
		Prob>chi2 = 0.00 Prob>chi2 = 0.73	Prob>chi2 = 0.00 Prob>chi2 = 0.97	Prob>chi2 = 0.00 Prob>chi2 = 0.64

Table 8. Partial and semi partial correlation matrix.

This table presents the partial and semi-partial correlation between the independent variables and each ratio: *MARKET-EBITDA*, *MARKET-SALES* and *MARKET-BOOK*. The partial correlation is the specific portion of variance explained by a given independent variable, considering that the rest of the variables are eliminated from the model. Semi-partial correlation is considering that the rest of the variables exist previously and the given variable is introduced.

	R. M-EBITDA			R.M-SALES			R.M-BOOK		
	Partial C.	Semipartial	Signif. V.	Partial C.	Semipartial	Signif. V .	Partial C.	Semipartial	Signif. V.
Size	0.1066	0.0996	***	0.2298	0.1509	***	0.2292	0.1505	***
GR	0.1382	0.1296	***	0.0189	0.0121	***	0.0096	0.0061	***
SGP	-0.0761	-0.0709	***	-0.0271	-0.0173	***	-0.0261	-0.0167	***
Year	-0.0158	-0.0147	**	-0.1185	-0.0762	**	-0.1189	-0.0765	***
Leverage	-0.2451	-0.2348	***	-0.5203	-0.3893	***	-0.5204	-0.3895	***
CodSector	0.1977	0.1873	***	0.2318	0.1523	***	0.2319	0.1524	***
Cod.Pais	0.017	0.0158	*	0.0362	0.0232	*	0.0366	0.0234	***
Working cap	-0.0243	-0.0226	***	0.0783	0.0502	***	0.0788	0.0505	***
Intang	-0.0920	-0.0858	***	0.0948	0.0608	***	0.0950	0.0610	***
Profitm/ROAm	---	---		0.4914	0.3605	***	0.4840	0.3534	***

To sum up the previous paragraphs we can conclude that *Size* includes: 1- economic factors over profitability, growth rate and risk and for this cause its coefficients are moderated with their inclusion. 2- However, the interactions with the rest of the variables also involve different investors' perceptions on *Size*. 3- Furthermore, we can observe in table (7) that, even after the introduction of the interactions, the individual effect of *Size* continues in the *MARKET-SALES* and *MARKET-BOOK* ratios, representing other compensation premiums not captured by the interactions.

With regard to table 8 we can appreciate that *Size* has a positive contribution on the explanation (R^2) of market ratios among the other economic variables, although, obviously, *Size* cannot replace the aggregated effect of economic variables, in accordance with previous studies in the American market (Bhojraj and Lee, 2002).

5. Conclusions and final remarks.

In this research, we present a model valuation to determine the necessary financial and economic control factors of firms in European market multiples. To dig more deeply into the *Size* problem, unlike previous works, we isolate it from a complete set of control factors, as well as their interactions with these variables over time.

According to Alford (1992), the value of the European ratios is influenced by the type of *Industry*, which is an important and relevant variable (table 5). *Country* is not significant in the *MARKET-EBITDA* and the *MARKET-SALES* ratios, involving a clear convergence of European countries in line with Young and Zeng (2015). We found only differences by *Country* in the *MARKET-BOOK* ratio until the introduction of profitability and risk variables (tables 4, 5 and 6). After this, *Country* is not significant in any ratio. *Year* is significant, so applying comparable firm ratios is very important considering the economic cycle.

Nevertheless, the parameters *Industry, Country,* and *Year* are not enough, and it is necessary to apply other control factors: *Size*, *profitability*, *risk* and *asset structural ratios* (tables 6 and 7). This is in accordance with the theoretical framework: Kim and Ritter (1999) indicated the necessity to add factors such as growth rate, profitability and leverage. Lie and Lie (2002) maintained that model accuracy depends on size and profitability. Alford also indicated that accuracy increases with size and decreases with leverage. Cheng and McNamara (2000), however, found that the best comparable firm definition is based on industry membership combined with return, compared with the size control factor. Bhojraj and Lee (2002) affirmed that ratios based on industry, profitability and risk variables are better than industry and size, but Franco et al. (2015) found that size, leverage, asset turnover and industry classification are the variables used by analysts in the selection of firms.

The problem in comparing previous works is the lack of consensus on the role of *Size* and on its relationships with the rest of the variables with respect to the three different ratios. In table 4, we noted a positive relationship of each ratio with *Size*, (*hypothesis 1)*, but also in table 6, the market ratios have a positive relationship with different profitability variables, as well as negative with *SGP*, leverage and *Working Capital*, (*hypothesis 2)*.

For each ratio, the size coefficient goes down when we add the previous variables (table 6). Therefore *Size* includes the economic characteristics of firms, especially those related to risk, profitability and growth rate. Furthermore, the significance of the interactions with the rest of the variables implies the inclusion of differential investors' perceptions about profitability and risk variables depending on *Size* groups (table 7) (*hypothesis 3)*. In this regard, there is extensive literature about returns on equity and the size problem: Banz (1981), Fama and French (1998) and Van Dijk (2011), nevertheless there are no previous studies in market ratios.

Also partial and semi partial matrix correlations (table 8) are confirming that *Size* is adding a differential value in the explanation of market ratios, despite the fact we can appreciate the superiority of the aggregated effect of economic variables.

These findings about *Size* represent important evidence for analysts and researchers. Based on our results *Size* is an important control factor to determine the peer group in market ratios. It incorporates an important imperfection about market efficiency because ratios of largest versus smallest enterprises perform differently with the same economic conditions, consequence of the investor's sentiment. Thus, ratios and therefore prices of small companies in capital markets could rise more than those of large ones when in a context of growth, profitability variables increase and required return decreases, even being overvalued in moments of economic expansion. However, in recessions, small companies' ratios would decrease more than what is "rational" comparatively to the largest one, starting an undervaluation process. This contrast will represent future research for authors taking a longer period of years, including economic bubbles and depressions.

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Annex.

Table A.1. Firms by peripheral and central countries.

Central countries (1)	Cod C.	Enterprises	Percent %	Peripheral countries (2)	Cod C.	Enterprises	Percent %
Germany	1	2,188	16.76	Bulgaria	4	20	0.15
Austria	2	279	2.14	Cyprus	5	27	0.21
Belgium	3	408	3.13	Croatia	6	75	0.57
Denmark	7	344	2.64	Slovakia	8	9	2.64
Finland	11	506	3.88	Slovenia	8	27	0.07
France	12	2,288	17.53	Spain	9	384	2.94
Luxembourg	19	122	2.64	Estonia	10	43	0.33
Netherlands	21	381	2.92	Greece	13	659	5.05
United Kingdom	24	2,517	19.28	Hungary	14	62	0.47
Sweden	27	901	6.90	Ireland	15	156	1.20
				Italy	16	727	5.57
				Latvia	17	95	0.73
				Lithuania	18	32	0.25
				Malta	20	26	0.20
				Poland	22	626	0.73
				Portugal	23	106	0.81
				Czech Rep.	25	20	0.15
				Romania	26	26	0.20
Total		9,934	78	Total		3,120	22
				Total		13,054	100

Source: AMADEUS (Bureau van Dijk) and own elaboration

Table A.2. Firms by industries.

Sector	Description	Firms	Percent %	Cum.
1	Agriculture, forestry and fishing	165	1.26	1.26
2	Mining and quarrying	344	2.64	3.9
3	Manufacturing industry	6,821	52.25	56.15
4	Supply of electricity, gas, steam and air conditioning	275	2.11	58.26
5	Water supply, sanitation activities, waste management and remediation	85	0.65	58.91
6	Construction	459	3.52	62.43
7	Wholesale and retail trade; repair of motor vehicles and motorcycles	995	7.62	70.05
8	Transport and storage	315	2.41	72.46
9	Hospitality	97	0.74	73.2
10	Information and communication	1,818	13.93	87.13
11	Real estate activities	404	3.09	90.23
12	Professional, scientific and technical activities	612	4.69	94.91
13	Administrative and support service activities	353	2.7	97.62
14	Education	17	0.13	97.75
15	Health activities and social services	81	0.62	98.37
16	Artistic, recreational and entertainment activities	113	0.87	99.23
17	Other services	100	0.77	100
	Total	13,054	100	

Source: AMADEUS (Bureau van Dijk) and own elaboration

Table A.3. Firms by industries and countries.

	Code of industries																	
Code of countries	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	Tot. Firms
1	17	14	1,205	78	13	30	180	49	3	365	72	61	40	0	23	24	14	2,188
2	0	13	185	6	0	6	0	10	8	25	22	3	0	0	0	0	1	279
3	8	8	228	7	0	17	21	22	0	46	33	10	0	2	0	1	5	408
4	0	0	19	0	0	0	0	0	0	1	0	0	0	0	0	0	0	20
5	2	2	9	0	0	0	1	4	0	0	0	7	0	0	2	0	0	27
6	1	1	41	0	0	2	0	1	13	11	0	2	2	0	0	1	0	75
7	2	2	234	4	0	18	15	5	0	35	12	0	9	0	0	6	2	344
8	0	0	18	0	0	0	0	12	4	2	0	0	0	0	0	0	0	36
9	0	12	223	28	0	28	10	0	3	18	37	10	9	0	2	1	3	384
10	0	0	20	0	4	6	7	0	0	0	0	0	0	0	0	6	0	43
11	0	2	337	8	2	18	35	21	0	72	0	9	2	0	0	0	0	506
12	30	50	1,117	40	16	42	174	25	32	494	80	99	55	10	9	13	2	2,288
13	19	10	348	1	10	41	92	33	13	36	13	10	4	0	7	3	19	659
14	0	9	35	1	0	0	0	0	0	10	7	0	0	0	0	0	0	62
15	0	6	86	0	0	5	19	14	0	9	0	7	7	0	0	3	0	156
16	3	9	473	33	1	42	11	28	7	70	20	11	0	0	0	19	0	727
17	13	6	53	9	0	0	2	5	0	0	0	0	0	0	7	0	0	95
18	2	3	10	6	0	2	4	0	0	3	0	0	2	0	0	0	0	32
19	27	9	45	0	0	0	0	2	0	27	3	9	0	0	0	0	0	122
20	0	0	7	0	0	0	0	0	0	12	0	4	0	0	0	3	0	26
21	0	7	204	0	0	30	32	5	0	42	11	29	11	0	3	4	3	381
22	9	16	288	20	0	45	85	7	4	65	40	23	22	0	2	0	0	626
23	0	7	51	0	0	9	3	0	3	27	1	0	0	0	0	5	0	106
24	32	130	1,083	24	39	87	216	64	6	283	47	250	171	4	16	14	51	2,517
25	0	0	9	5	0	0	6	0	0	0	0	0	0	0	0	0	0	20
26	0	3	18	5	0	0	0	0	0	0	0	0	0	0	0	0	0	26
27	0	25	475	0	0	31	82	8	1	165	6	68	19	1	10	10	0	901
Tot. Firms	165	344	6,821	275	85	459	995	315	97	1,818	404	612	353	17	81	113	100	13,054

(Endnotes)

[1] This methodology uses future free cash flow projections and discounts them. It usually uses the weighted average cost of capital, WACC, and the capital asset price model, CAPM, to obtain a present value that represents the investment value.

[2] The Standard Industrial Classification *SIC* is a system for classifying industries by a four-digit code, established in the United States in 1937.

[3] $V_J = MX_J + \varepsilon_J$ for $j = 1, \ldots, N$ where V and X denote the value and a measure of financial or operating performance for firm j, M is a multiple that is constant across N firms of a particular industry, and ε is an error which reflects the variation in multiples across firms within an industry.

[4] Fama and French, with the three factor model, captured size SMB and value with the ratio book-to-market equity, HML, effects that are systematically associated with returns, across this expression: $E = Rf + \left(E\left(Rm\right) - Rf\right)\beta i, m + SMB\beta i, s + HML\,\beta i, v$

[5] Represents the cash generated by assets that a company is able to distribute among all the security holders and financial creditors of a corporate entity.

[6] The WACC is the average discount rate required by the company's firm financial structure. So, WACC = Ke E / EV + Kd D / EV, where K_e is the required return of shareholders or capital, E, is the market value of the equity, K_d, is the return of financial debt, D, is the financial debt amount, and EV is the market value of the company. In turn, Ke is calculated from the CAPM model where size premium is discussed by many authors.

[7] In our research this transformation also avoids endogeneity problems, neglecting after this transformation null hypothesis of endogeneity across stata's stoverid test.

[8] In this process, we obtain the fixed-effects estimates for time-varying regressors. In addition, we get a random-effects estimate for the time-invariant regressors. This technique is also developed in Chapter 10 in Wooldridge (2010) and Schunck (2013) for panel data models.

[9] VCE, command (robust), allows the estimation although there are problems of heteroscedasticity and autocorrelation and we must avoid bias and inefficiency of the coefficients (Hoechle 2007). Finally, to control endogeneity, we have checked the robustness of the results, delaying the variables that include market capitalization in their calculation, size and leverage ratio, one period, ensuring that the results basically do not change.

[10] The differences are calculated over the intercept, or country one, Germany.

[11] These coefficients (*B*) turn out to be an approximation on the variation regarding the intercept. The exact calculation of the variation is $(1\text{-}e^B)$.

[12] The independent variables have an individual medium FIV <2.5, which involves an $R2<0.60$ and a tolerance index over 0.40.

[13] To abbreviate table 7, we have omitted the coefficients relative to the variables "Industry" and "Country" because the coefficients' significance does not change after the introduction of the new variables, so they do not provide new information about the previous model.