

## THE VALUATION BY MULTIPLES OF ITALIAN FIRMS

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### Abstract

The purpose of this paper is twofold. First, the paper illustrates which comparables selection method provides the most accurate forecasts by using multiples. Firms listed on the Milan stock exchange from 2000 to 2006 were analyzed. Comparable firms were selected by activity sector, sector and size, sector and ROA, ROA and size, and were averaged with the arithmetic mean, median, and harmonic mean. Twelve multiple valuation methods were analyzed. The empirical results suggest that the selection of comparable firms on the basis of sector and ROA or sector and size are the most accurate criteria. Valuation improves when multiples are averaged using a median relative to arithmetic and harmonic mean. Moreover, in order to test which multiples are most effective to value a company, the main multiples were considered and I analyzed how factors such as sector, size and year bias these outcomes. The results show that the multiples based on cash flows are almost always significant; the multiples based on earnings are most significant in industrial sectors, in particular for small firms with many intangible assets; the multiples on book value appear most effective for non-industrial firms.

**Keywords:** firm valuation, earnings, assets, ROA, Italy

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### 1. Introduction

The concept of firm value has an indisputable role in both strategic choices and decision-making.

To evaluate a firm, the common practice of the financial community is to adopt the method of market multiples as an alternative to traditional discounted cash flow (DCF). This method allows us to determine company value by applying valuation multiples (e.g. P/E, price/cash flow, price/book value, price/sales, enterprise value/sales, enterprise value/EBITDA, enterprise value/EBIT) to their business fundamentals. The valuation multiples are observed in a sample of companies (comparables) operating in the same sector as the company evaluated.

Normally, the DCF method expresses results which are stable over time, particularly in the short term. By definition, the multiples approach is unstable, as a result of the volatility of market prices. This is not only due to the irrational behaviour of investors, but also the evolution of supply and demand. It should be added that while the DCF method needs many resources and much time (analysts, historical information, and forecasting), the multiples approach has always been seen as a quick instrument of evaluation. For this and other reasons, the use of the market multiples has taken on an increasingly important role in company valuation. Guatri-Bini (2002) argue, for instance, that this is due to the steady rise in stock prices over a long period, the importance of intangible assets, the information advantage attributed to multiples, and the diffusion of extraordinary finance operations.

There are three objectives of this work, which I applied to a sample of Italian companies listed on the Milan stock exchange.

1. I tested how the comparables should be selected or what selection criterion (sector, profitability, size) leads to minor evaluation errors in the evaluation through market multiples. I also investigated how the average value of multiples observed for comparables (median, arithmetic average, harmonic average) should be calculated.
2. I verified the effectiveness of the main multiples (price/earning, price/book value, price/sales, enterprise value/sales, enterprise value/book value, enterprise value/EBIT, enterprise value/EBITDA, enterprise value/free cash flow) in equity and firm evaluation.
3. In the conclusion of the paper I give an idea of the weight that factors such as sector, size, and year have in determining this effectiveness.

Several different reasons motivated the research presented in this paper.

In Italy, empirical studies on this field are absent. Furthermore, the Italian stock exchange is peculiar in terms of liquidity, average size and concentration. It is characterized by a smaller average capitalisation and by a greater concentration. A small cap of Wall Street is reasonably a blue chip in Italian market. The small stocks have generally little floating and lower

volumes of contracting. The effect of largest concentration is that, in relative terms, the difference of capitalisation among small and big firms in Italy is smaller than the same in US market. These reasons may justify a different nature of the correlations between prices and corporate fundamental.

Throughout the international panorama, theoretical literature is plentiful, but empirical literature is not equally so. Moreover, the empirical literature is segmented, due to a lack of continuity in temporal execution, research objectives, and the presentation of results. For these reasons, it is necessary to summarize the results of previous studies, in current work I make this.

In the financial practice, while it is important to have a variety of valuation instruments, it is more important to know valuation error (VE). Regarding this aspect, this paper adds to international literature because the valuation errors are measured for multiples and have been broken down by business sector, year, and size. Only by knowing the determinant of valuation errors will the valuation improve and become truly objective.

In the next section there is a synoptic presentation of the main results of international empirical research. Section 3 shows analysis methods, samples, and the main results of this empirical testing. The last section is dedicated to some final considerations.

## **2. International Empirical Evidence**

In the empirical review presented here, I analyzed 20 studies, attempting to provide a framework of the results in the international field. The studies considered have essentially two objectives (except the Hotchikiss and Mooradian (1998) study, which estimated the discount purchase of firms in a state of financial trouble).

1. In some papers, they tested how the valuation multiple should be defined. What are the most suitable selection criteria in the selection of comparables (sector, profitability, size, growth rate)? Or, once the comparables have been identified, should the comparable value be estimated with the median, the arithmetic, or harmonic mean? Many assert there is no problem in choice of comparables since this is an “art form” that does not need technicalities, but the empirical results of studies here analyzed try to give credence to the various methods consolidated in practice.
2. As regards the second objective, other empirical researchers tested which multiple is most effective in evaluation.

Following are some details of the examined studies, in terms of methods, and the main results separate in respect to the two objectives outlined above are also sketched.

## **Aspects of Method**

The efficacy of a multiple in the evaluation is empirically verified in two ways.

The first method consists of testing the significance of the link between the observed market price and the driver of value used in the construction of a multiple. Obviously, the greater the significance of a particular driver the greater the quality of a multiple constructed upon it.

The second method, more recently implemented, is to compute the valuation error (VE) for a sample of listed firms. The VE is the ratio or the percentage difference between the estimated value through the evaluation multiple and the observed value in the market. In some studies, the VE is calculated as the natural logarithm of the relationship between the estimated and observed value. The study of Dittmann and Maug (2006) demonstrated that the results of these studies are more reliable than those in which the VE is calculated in another way.

The comparable value is usually calculated by arithmetic mean or median of multiples for a set of comparables, but the Liu et al. (2002) and Baker and Ruback (1999) studies show that the harmonic mean leads to better results than the arithmetic mean and median.

In a sample of observations a multiple is good if the mean or median of the VE is equal to zero (when it is calculated as a difference) or is equal to one (when it is a ratio). This approach is based on the assumption that the value expressed by the market is correct, and for this reason the studies of Gilson et al. (2000), Kaplan and Ruback (1995), and Kim and Ritter (1999) took the estimated value through the DCF in place of the observed value.

To test the maximum and minimum levels of the multiples’ effectiveness, it is necessary to compare their VEs. A multiple is generally more effective if its average VE is smaller.

When the empirical testing has the objective of verifying which selection criteria of comparables is more effective, as many VEs as selection criteria are calculated, the best selection criteria is that corresponding to the lowest average VE.

The selection criteria tested in the studies analyzed here are described below.

- Sector – The selection of comparables relating to the sector of firm valuated is the criteria most widespread in financial practice. In the studies analyzed here, it emerges that in prevalence they refer to the SIC classification, taking into account 4 digits, which was reduced only if the number of comparables was not acceptable (less than four comparables). The study conducted by Eberhart (2004) tested if the validity of the evaluations by the multiple depends on industrial classification chosen (nine are investigated); the VE is smallest (the

valuation is most correct) using the Dow Jones classification.

- Profitability – Select comparables identifying those companies that have a ROA (or another indicator of profitability) differing from that to be evaluated by less than a certain percentage. The choice of that percentage is arbitrary; for example, in the studies of Dittman and Weiner (2005) and Alford (1992), researchers set it at 2%.
- Size – In this case, it uses the same logic used for profitability. For example, the Dittman and Weiner (2005) used total assets as proxy of size, and always set the range of selection at 2%.
- Profitability and size – If the two aspects are taken into account at the same time, the range of selection is generally fixed at a higher level. For Dittman and Weiner (2005) and Alford (1992), the comparables are firms which differ from evaluated firms by less than 14%, both in terms of ROA and in terms of total assets.
- Growth rate – In general, the percentage change of past earnings or those expected (Boatsman and Baskin, 1981; Zarowin, 1990) is taken as proxy for the rate of growth.

In terms of method, among the studies listed above, only the technique used in Bhojraj and Lee (2002) stands out. They did not calculate a multiple of evaluation on the basis of a set of comparables. They estimated, for a period prior to that of evaluation, the single and multiple coefficients of regression between two multiples as the two dependent variables (enterprise value/turnover and price/book value), and eight independent variables<sup>[1]</sup>. The coefficients of regression thus determined were then used to estimate the multiple of evaluation in function of the eight independent variables observed for the evaluation period. This approach is based on the assumption that the choice of comparable is a function of the variables that influence the market multiple used in the assessment. The message that the authors wanted to convey is that perhaps its choice may be made less subjective and more systematic.

As regards the sample, in all the studies (with the exception of the studies by Herrmann and Richter (2003) and Dittman and Weiner (2005), which take into account a sample of US and European companies) the tested values are based on US data.

### **The Main Results: How to Estimate the Comparable Value**

The results of the studies analyzed do not lead to definitive conclusions.

Boatsman and Baskin (1981) and Zarowin (1990) tested the efficacy of the E/P multiple when comparable value is determined by reference to the industrial sector alone, and with constraints in terms

of historical rate of growth of profits. They note, in this case, that the valuation error is smaller. However, in reference to the same multiple, Alford (1992) asserts the choice of a comparable value based on one sector alone or in combination with other factors (such as the ROE and total assets) leads to in either case to the same evaluation.

In relation to the multiples “enterprise value/sales” and “price/book value”, Cheng and McNamara (2000) show that the most appropriate criteria for the selection of comparables is to consider the sector and total assets together. Whereas, Bhojraj and Lee (2002) say that if one selects the comparables taking into account profitability, rate of growth, and financial risk, the valuation errors are minor.

Dittman and Weiner (2005) tested how to choose the comparables using multiple enterprise value/EBIT. They analyzed a sample of European and US companies for 10 years (1993-2002) and they observed different results. For the US, the UK, and Ireland, the valuation error is minimized when the comparable value is similar in term of sector, ROA and total assets. For the other countries (including Italy), it is preferable to use only the ROA, in addition to sector. However, for Italy the selection by the industrial sector appears to produce better results than it does for other countries. For the US, the UK, Denmark, and Greece, it is better to choose the comparables in the same country of company appraised. For the other members, it is better to refer to comparables of the European Union. As regards the determinant “time,” they do not outline a trend in VE over the years, but indicate a peak in 1999-2000 by a speculative bubble; they then return in 2001-2002 to levels previous to 1998.

The evidence given by the Herrmann and Richter (2003) study adds that proxies of the rate of growth and profitability are a relevant criterion, together with the SIC code, for the selection of comparables.

With the selection of comparables by sector, the most correct valuation was achieved by calculating the comparable value with the harmonic mean of observations (Dittmann and Maug, 2006).

### **The Main Results: Which Multiple Is Most Effective in Valuation?**

Hotchikiss and Mooradian (1998) used the multiples “enterprise value/sales” and “enterprise value/assets” to estimate the acquisition price of companies in financial distress. The authors found these firms were bought with a discount of 40-70%, with respect to the value defined by the multiple (the multiple overestimate the firm value).

In the same way, Kim and Ritter (1999), Chang and Tang (2002), and Deloof et al. (2002) observed that, for a sample of US companies, the multiples “price/asset” and “price/sales” produce overprice of firm market value. In contrast, Eberhart (2004) and Lie and Lie (2002) found that using the multiple “enterprise value/sales” leads to correct assessments.

Several studies indicate that the more significant results are for multiples based on earnings.

In some studies, comparing the estimated value through the DCF with the value determined by multiples (P/E, price/book value, price/sales, enterprise value/sales, enterprise value/EBITDA), it emerged that the best multiple was “enterprise value/EBITDA”. The results were the same if the sample observed is composed of companies involved in IPOs (Kim and Ritter, 1999), in financial distress (Gilson et al., 2000), or with high leverage (Kaplan and Ruback, 1995). Gilson et al. (2000) added that the best results were obtained if the comparable value is the median value of comparables in same sector. In general, the three studies say that multiples based on earnings are the best, followed by those on cash flows, the book value, and sales.

Eberhart (2004) points out that the best multiples are enterprise value/sales, P/E, and enterprise value/EBIT. If the enterprise value is adjusted for cash,<sup>[iii]</sup> only the sales multiple offers acceptable results.

Lie and Lie (2002) produced similar results regarding “enterprise value/sales” and the “P/E” multiples, but note that the P/E is better if earnings are those provided (I/E/B/S) rather than those observed. Results also indicated that multiples based on EBITDA work better than those based on EBIT. The authors repeated the analysis for subsamples differentiated in terms of size, presence of intangibles, and type of business (financial to non-financial firms). Taking into account the size (by book value and earnings level), it emerged that large companies earn the best appraisals. For small firms, the earnings did not seem able to adequately describe the dynamic of prices, whereas the value of large companies is able to continuously follow the market because they have many projects. For both large and medium-small

firms, the asset side multiples were the best. Companies with more intangibles were not correctly assessed through multiples; in relation to business, the best results were for the financial firms.

Liu et al. (2002) noted that the multiples on earnings explain the price of stocks better than other multiples. These results were obtained for each year of observation. Following these in effectiveness were the multiples based on cash flow. Contrary to Lie and Lie (2002), Liu et al. (2002) get the same results in all sectors examined, and thus the sector does not seem to be a discriminatory variable. Lie and Lie (2007) improved their initial research by extending the analysis to other markets and taking into account the forecasts on earnings and cash flows in place of the values observed. Their results do not differ much from those initial ones: multiples on observed earnings always seem to be the best.

Cheng and McNamara (2000) argue that the P/E is better than the price/book value. Similarly, Bajaj et al. (2004) affirm the importance of the P/E for all companies showing extremes (either high or small) in current earnings.

### 3. Empirical Test on Italian Firms

#### 3.1 Methodology

The analysis, performed on a sample of firms listed on the Milan stock exchange in the period 2000-2006, was conducted in two phases. The analysis was not extended over last years in order to avoid a bias in the results due to the irregular market.

Firstly, I tested which of four different selection criteria and which of three methods of averaging involve fewest valuation errors, when applying the PE, PB, PS, EVEBIT, and EVFCF multiples (Table 1).

**Table 1.** Multiples Used in Analysis

	Multiples	Abbreviation
Equity side	price/book value of stock	PB
	price/EPS	PE
	price/sales per share	PS
Asset side	enterprise value/sales	EVS
	enterprise value/book value	EVB
	enterprise value/EBITDA	EVEBITDA
	enterprise value/EBIT	EVEBIT
	enterprise value/free cash flow	EVFCF
	adjusted enterprise value/sales	EVS <sub>adj</sub>
	adjusted enterprise value/adjusted book value	EVB <sub>adj</sub>
	adjusted enterprise value/EBITDA	EVEBITDA <sub>adj</sub>
	adjusted enterprise value/EBIT	EVEBIT <sub>adj</sub>
	adjusted enterprise value/free cash flow	EVFCF <sub>adj</sub>

Notes:

enterprise value = market capitalization + total debts – financial assets

adjusted enterprise value = enterprise value – cash and equivalent

book value = equity + total debts – financial assets

adjusted book value = book value – cash and equivalent

The four investigated selection criteria are described below.

- Sector – Considering the sector (ATECO 2002 code), the comparables have been identified on the basis of the first four digits; if their number was less than four, only the first two digits were considered.
- Sector and profitability – The comparables must belong, on the basis of the first two digits of the ATECO classification, to the same sector. Additionally, they must have a profitability (measured by the ROA) within 2%.
- Sector and size – The comparables must belong, on the basis of the first two digits of the ATECO classification, to the same sector. And they must have a size, measured by the natural logarithm of the total assets, within 10%.
- Profitability and size - Comparables must have a profitability (measured by the ROA) that does not differ by more than 2%, and a size (measured by the natural logarithm of total assets) which does not differ by more than 10%.

For the last three selection criteria, three is the minimum number of comparables. Otherwise, an excessive number of observations would have been lost.

The comparable value was obtained by calculating, on their multiples, the arithmetic mean, the median, and the harmonic mean.

With reference to each multiple, values for each year and each firm in the sample the VEs were calculated as follows:

$$VE_t = |\ln(EV_t) - \ln(OV_t)|$$

where  $EV_t$  = estimated value at June 30th of year  $t$ , applying the comparable value to the firm's fundamental for year  $t-1$ , and  $OV_t$  = observed value at June 30th of year  $t$ .

This means that, from intersection selections criteria/averaging, for every multiple twelve series of VE are obtained (on firm/year observations).

It has been tested the significance of the difference among average values of VE obtained with alternative selection criteria/calculation comparable value. The method of evaluation is effective if the average VE is not significantly different from zero (the estimated value is close to the observed value), and is best if the average VE is lower.<sup>[iii]</sup>

In the second stage of the research, the comparables (for each company and in each year of observation) are identified through the combination of selection criteria and calculation comparable value

that is more effective in the initial phase. With reference to the thirteen multiples in Table 1, I have adopted the same logic followed in previous step to calculate VEs. Among the results, the best multiple is that which leads to the smallest valuation errors.

This testing has also been replicated for subsamples of observations distinguished by the following criteria.

- Year of observation.
- Business. It was investigated whether the VEs are different between the industrial sector, the energy and service sector, and banks/insurance/real estate activities (ATECO 2002 code); or between non-industrial firms and traditional sectors companies, separated with according to scale economy and sectors with high specialization and high technology (PAVITT taxonomy)<sup>[iv]</sup>.
- Size. The proxies of size used here are sales and number of employees.

The objective of this last detail is to find whether these aspects are effectively determinants of the main market multiples.

### 3.2 The Sample

The sample was selected by identifying the firms listed on January 1, 2008, with available data (market data and budget) in the AIDA database for the years 2000-2006.<sup>[v]</sup>

Each observation is given as company-year; note that the number of observations is not the same for each year, since the availability of data is not the same for all years (the least represented ones are 2000 and 2006). The number of observations of each year also varies in function of the multiple analyzed (for multiples based on earnings, the firms with negative earnings were not taken into account) and the selection criteria adopted in the selection of comparable (the different on fixed minimum number of comparables leads to excluding a different number of observations).

Table 2 shows the distribution of observations by sector (ATECO 2002), selection criteria, and multiple used in the valuation.

Without breakdowns in terms of multiple, the total number of company-year observations for which VE are calculated is 6,896, when the selection criterion is the sector; 1,618 if – in addition to sector – I take profitability into account; 4,052, when the second variable considered is size; and 6,351 in the case of profitability plus size.

Taking the selection criteria/evaluation multiple into account, the number of observations ranges from 77 as the lowest (analysis of EVFCF, selection by sector and profitability) to 630 as the highest (analysis of PB, PS, EVS, and EVB, selection by sector).

**Table 2.** Observation Distribution (ATECO 2002 code), by Tested Multiple and Selection Criteria

Multiple	Selection criteria	Sector															total
		17	22	24	26	29	31	45	51	52	63	65	70	72	74	92	
PE	SEC	10	18	5	39	54	16	34	8	5	12	42	40	20	42	13	<b>358</b>
	SEC+PROF	7	0	0	0	18	0	13	4	0	0	10	16	0	18	0	<b>86</b>
	SEC+SIZE	3	0	1	19	37	15	24	5	2	0	39	20	9	14	4	<b>192</b>
	PROF+SIZE																<b>309</b>
PB	SEC	43	32	33	50	64	26	38	27	25	14	79	52	46	66	35	<b>630</b>
PS	SEC+PROF	12	3	0	5	23	0	15	4	0	0	35	18	0	26	0	<b>141</b>
EVS	SEC+SIZE	29	7	14	30	49	25	27	10	3	0	60	36	39	35	22	<b>386</b>
EVB	PROF+SIZE																<b>601</b>
EVS <sub>adj</sub>																	
EVB <sub>adj</sub>																	
EVEBITDA	SEC	42	32	30	48	64	26	37	20	22	15	71	47	43	53	20	<b>570</b>
	SEC+PROF	12	3	0	5	23	0	15	4	0	0	35	18	0	23	0	<b>138</b>
	SEC+SIZE	26	7	11	29	49	25	25	9	3	0	54	33	34	18	1	<b>324</b>
	PROF+SIZE																<b>453</b>
EVEBIT	SEC	21	26	16	43	60	21	36	14	10	13	55	43	21	46	0	<b>425</b>
	SEC+PROF	8	1	0	5	23	0	15	4	0	0	31	18	0	23	0	<b>128</b>
	SEC+SIZE	10	4	7	21	44	20	22	6	2	0	43	26	10	13	0	<b>228</b>
	PROF+SIZE																<b>405</b>
EVEBIT <sub>adj</sub>	SEC	30	22	21	41	37	22	23	13	8	9	54	23	19	36	26	<b>384</b>
	SEC+PROF	2	3	0	1	8	0	9	4	0	0	27	5	0	18	0	<b>77</b>
	SEC+SIZE	12	4	10	23	23	21	16	8	0	0	41	18	14	18	12	<b>220</b>
	PROF+SIZE																<b>360</b>

*Notes:*

ATECO 2002 code

17 Textile industries

22 Publishing, printing and video reproduction

24 Chemical products and man-made fibres

26 Manufacture of products from the mining of non-metallic minerals

29 Manufacture of machinery and mechanical appliances

31 Manufacture of electrical machinery and apparatus

45 Buildings

51 Wholesale and intermediaries in commerce

52 Retail

63 Support activities to transport

65 Monetary and financial intermediation

70 Real-estate activities

72 Computer and related activities

74 Business services

92 Recreational, cultural and sporting activities

SELECTION CRITERIA

SEC selection by sector

SEC + PROF selection by sector and profitability

SEC + SIZE selection by sector and size

PROF + SIZE selection by profitability and size

**Table 3.** Mean of Differences Between VEs, Comparison in Terms of Selection Criteria, and Methods of Averaging (total observations without distinction by multiples)

		Mean of difference
<i>A. Comparison Between Selection Criteria</i>		
arithmetic mean	SEC vs. SEC+PROF	0.357
	SEC vs. SEC+SIZE	0.334
	SEC vs. PROF+SIZE	0.400
	SEC+PROF vs. SEC+SIZE	0.069**
	SEC+PROF vs. PROF+SIZE	0.256
	SEC+SIZE vs. PROF+SIZE	0.354
	SEC vs. SEC+PROF	-0.134
median	SEC vs. SEC+SIZE	-0.098
	SEC vs. PROF+SIZE	-0.321
	SEC+PROF vs. SEC+SIZE	0.038**
	SEC+PROF vs. PROF+SIZE	0.311
	SEC+SIZE vs. PROF+SIZE	-0.211

Table 3 continued

	SEC vs. SEC+PROF	-0.184
	SEC vs. SEC+SIZE	-0.131
harmonic mean	SEC vs. PROF+SIZE	-0.212
	SEC+PROF vs. SEC+SIZE	-0.017**
	SEC+PROF vs. PROF+SIZE	-0.170
	SEC+SIZE vs. PROF+SIZE	-0.156
<i>B. Comparison Between Methods of Averaging</i>		
SEC	arithmetic mean vs. median	0.817
	arithmetic mean vs. harmonic mean	1.098
	median vs. harmonic mean	0.281
SEC+PROF	arithmetic mean vs. median	0.549
	arithmetic mean vs. harmonic mean	0.799
	median vs. harmonic mean	0.249
SEC+SIZE	arithmetic mean vs. median	0.497
	arithmetic mean vs. harmonic mean	0.747
	median vs. harmonic mean	0.250
PROF+SIZE	arithmetic mean vs. median	0.321
	arithmetic mean vs. harmonic mean	0.432
	median vs. harmonic mean	0.123
<i>Notes:</i>		
SEC selection by sector		
SEC + PROF selection by sector and profitability		
SEC + SIZE selection by sector and size		
PROF + SIZE selection by profitability and size		
** significant at the 5% level		

### 3.3 Results

#### Which Comparable is most Useful in the Valuation of Italian Firms?

The mean VEs were first observed without distinction in terms of multiple, comparing VEs by selection criteria/calculation comparable value for all the multiples (Table 3).

With the method of averaging being fixed, when comparing the selection criteria, the VEs differ

significantly if the comparables are selected taking account of the sector and profitability relative of the sector and size. That is to say, evaluations are similar when firms are only selected by sector or jointly/alternately by profitability and size.

Another result is that with equal selection criteria, the valuation error does not differ significantly with alternative average; additionally, the last entries in the table show that the mean of differences is never significant.

Table 4. Mean and Median of VEs (total observations without distinction by multiples)

Methods of averaging	Selection criteria	Mean	Median
arithmetic mean	SEC	0.666	0.533
	SEC+PROF	0.416	0.337
	SEC+SIZE	0.501	0.374
	PROF+SIZE	0.701	0.603
median	SEC	0.151**	0.054
	SEC+PROF	0.048**	0.000
	SEC+SIZE	0.081**	0.009
	PROF+SIZE	0.170	0.080
harmonic mean	SEC	0.431	0.245
	SEC+PROF	0.297	0.107
	SEC+SIZE	0.331	0.180
	PROF+SIZE	0.803	0.605
<i>Notes:</i>			
SEC selection by sector			
SEC + PROF selection by sector and profitability			
SEC + SIZE selection by sector and size			
PROF + SIZE selection by profitability and size			
** significant at the 5% level			

The means of VE for the twelve selection criteria/calculation comparable value shows additional evidence (Table 4). The valuation errors are statistically significant only when the comparable value is average through the median; the mean is less (0.048) if the comparables are selected by sector and profitability; they follow the mean of VEs when the selection criterion is sector with size (0.081); and in the last only sector (0.151). The valuation leads to errors which are statistically different from zero as the selection criterion is profitability with size.

As regards the analysis on separate VEs by multiple, I have always found (with the selection criteria PROF+SIZE) that the VEs or means of differences are always not statistically significant; therefore, the data is not shown in the tables.

Examining the means of the differences (Table 5), the comparison in terms of selection criteria does (equal means) not lead to homogeneous results<sup>[vi]</sup>.

Selecting the comparable with reference to sector, rather than sector and size jointly, never leads to significant differences in VE values unless you use the EVEBIT multiple.

If the comparables are selected by sector alone, rather than by sector and profitability, the VEs are significantly different when using PB, PS, and EVFCF multiples (though not for the evaluation by PE and EVEBIT).

When one compares the selection by sector and profitability with that by sector and size, the VE values are significantly different if you are using the PE and PS multiples, while the results are not homogeneous for other multiples.

Mean VEs by the selection criteria/calculation comparable value confirms the results on total

observations (Table 6) and provides yet further indications for application.

VEs are statistically equal to zero only when one uses the median, and this is true for all multiples. Using the EVFCF multiple, one will have good appraisals if the comparable value is calculated with harmonic mean.

When the comparables are selected by sector alone, among the results obtained by using the median, the valuation errors are never significantly equal to zero. For the other two selection criteria, the valuations are best if in addition to the sector it consider the profitability (with the PE, PS, and EVEBIT multiples) and the size (with PB and EVFCF multiples).

Trying to summarize the results obtained, in evaluation by market multiples the errors are next to zero (statistically significant) if you calculate the comparable value through median rather than the arithmetic mean or harmonic mean.

The evaluations are not correct if one chooses the comparables by sector alone, or by size and profitability jointly. On the other hand, in order to avoid significant errors, one must take profitability and size into account, in addition to the sector. In particular, in the evaluation by PE, PS, and EVEBIT, the first of the last two criteria produces better results; in the evaluation by PB and EVFCF the second one is preferable.

This means that in the second step of analysis, for multiples based on earnings and sales, the comparables were selected taking sector and profitability into account; for multiples based on book value or cash flow I have used the criteria SEC+SIZE. The average value was always calculated using the median.

**Table 5.** Mean of Difference Between VEs, Comparison in Terms of Selection Criteria (total observations with distinction for multiple)

Multiple	Methods of averaging	Comparison	Mean of difference
PE	arithmetic mean	SEC vs. SEC+PROF	0.301
		SEC vs. SEC+SIZE	0.242
		SEC+PROF vs. SEC+SIZE	0.298***
	median	SEC vs. SEC+PROF	-0.107
		SEC vs. SEC+SIZE	-0.084
		SEC+PROF vs. SEC+SIZE	0.094**
	harmonic mean	SEC vs. SEC+PROF	-0.139
		SEC vs. SEC+SIZE	-0.082
		SEC+PROF vs. SEC+SIZE	-0.028***
PB	arithmetic mean	SEC vs. SEC+PROF	0.319***
		SEC vs. SEC+SIZE	0.403
		SEC+PROF vs. SEC+SIZE	0.010
	median	SEC vs. SEC+PROF	-0.018**
		SEC vs. SEC+SIZE	-0.053
		SEC+PROF vs. SEC+SIZE	-0.094
	harmonic mean	SEC vs. SEC+PROF	-0.035***
		SEC vs. SEC+SIZE	-0.113
		SEC+PROF vs. SEC+SIZE	-0.147
PS	arithmetic mean	SEC vs. SEC+PROF	0.701**
		SEC vs. SEC+SIZE	0.424
		SEC+PROF vs. SEC+SIZE	-0.070**
	median	SEC vs. SEC+PROF	-0.052**
		SEC vs. SEC+SIZE	-0.154
		SEC+PROF vs. SEC+SIZE	-0.112**
	harmonic mean	SEC vs. SEC+PROF	-0.138**
		SEC vs. SEC+SIZE	-0.251
		SEC+PROF vs. SEC+SIZE	-0.249**



Table 5 continued

EVEBIT	arithmetic mean	SEC vs. SEC+PROF	0.306
		SEC vs. SEC+SIZE	0.343
		SEC+PROF vs. SEC+SIZE	0.032***
	median	SEC vs. SEC+PROF	-0.299
		SEC vs. SEC+SIZE	-0.046**
		SEC+PROF vs. SEC+SIZE	0.305
harmonic mean	SEC vs. SEC+PROF	-0.393	
	SEC vs. SEC+SIZE	-0.033***	
	SEC+PROF vs. SEC+SIZE	0.327	
EVFCF	arithmetic mean	SEC vs. SEC+PROF	-0.067**
		SEC vs. SEC+SIZE	0.124
		SEC+PROF vs. SEC+SIZE	0.279
	median	SEC vs. SEC+PROF	-0.255**
		SEC vs. SEC+SIZE	-0.147
		SEC+PROF vs. SEC+SIZE	0.094**
harmonic mean	SEC vs. SEC+PROF	-0.246	
	SEC vs. SEC+SIZE	-0.096	
	SEC+PROF vs. SEC+SIZE	0.141	

Notes:

SEC selection by sector

SEC + PROF selection by sector and profitability

SEC + SIZE selection by sector and size

\*\* significant at the 5% level

\*\*\* significant at the 10% level

Table 6. Mean and Median of VEs (total observations by tested multiple)

Multiple	Methods of averaging	Selection criteria	Mean	Median
PE	arithmetic mean	SEC	0.523	0.481
		SEC+PROF	0.462	0.459
		SEC+SIZE	0.305	0.347
	median	SEC	0.220	0.009
		SEC+PROF	0.100**	0.017
		SEC+SIZE	0.173**	0.000
harmonic mean	SEC	0.492	0.208	
	SEC+PROF	0.419	0.183	
	SEC+SIZE	0.424	0.119	
PB	arithmetic mean	SEC	0.600	0.481
		SEC+PROF	0.358	0.349
		SEC+SIZE	0.324	0.394
	median	SEC	0.125	0.003
		SEC+PROF	0.071**	0.069
		SEC+SIZE	0.070**	0.001
harmonic mean	SEC	0.338	0.191	
	SEC+PROF	0.258	0.206	
	SEC+SIZE	0.213	0.113	
PS	arithmetic mean	SEC	0.986	0.681
		SEC+PROF	0.873	0.462
		SEC+SIZE	0.601	0.375
	median	SEC	0.111	0.016
		SEC+PROF	0.027**	0.047
		SEC+SIZE	0.065**	0.020
harmonic mean	SEC	0.572	0.442	
	SEC+PROF	0.512	0.246	
	SEC+SIZE	0.442	0.391	
EVEBIT	arithmetic mean	SEC	0.592	0.595
		SEC+PROF	0.310	0.170
		SEC+SIZE	0.404	0.459
	median	SEC	0.219	0.011
		SEC+PROF	0.061**	0.039
		SEC+SIZE	0.144**	0.026
harmonic mean	SEC	0.397	0.130	
	SEC+PROF	0.128	0.013	
	SEC+SIZE	0.336	0.143	
EVFCF	arithmetic mean	SEC	0.469	0.464
		SEC+PROF	0.444	0.608
		SEC+SIZE	0.366	0.295
	median	SEC	0.118	0.051
		SEC+PROF	0.036**	0.145
		SEC+SIZE	0.019**	0.019
harmonic mean	SEC	0.336	0.193	
	SEC+PROF	0.122**	0.042	
	SEC+SIZE	0.260	0.128	

Notes:

SEC selection by sector

SEC + PROF selection by sector and profitability

SEC + SIZE selection by sector and size

\*\* significant at the 5% level

### Which Multiple is Most Useful in the Valuation of Italian Firms?

In the analysis on total observations (Table 7 – Panel A), the best multiples in the assessment are PB, PE, PS, EVEBIT, EVFCF, and EVFCF<sub>adj</sub>. In fact, for these multiples, the VEs are minor and do not differ statistically from zero. Therefore, the hypothesis the experiments were based on is confirmed by the results.

Observation of the average VE values over the six-year period (Table 7 – Panel B) offers a partial confirmation of the accuracy of the initial results. A sample comparison of the results demonstrates this: for 2002 the PB, PE, and PS multiples are not significant; EVEBITDA and EVEBITDA<sub>adj</sub> are significant from 2003, but with a higher VE value; in 2003, the multiples based on EBIT are also significant.

**Table 7.** VE Mean in the Analysis Period

<i>A. Total Observations</i>							
<b>Multiple</b>	<b>VE mean</b>						
PB	0.070***						
PE	0.100**						
PS	0.023**						
EVS	0.193						
EVB	0.159						
EVEBITDA	0.445						
EVEBIT	0.061**						
EVFCF	0.019**						
EVS <sub>adj</sub>	0.105						
EVB <sub>adj</sub>	0.230						
EVEBITDA <sub>adj</sub>	0.146						
EVEBIT <sub>adj</sub>	0.137						
EVFCF <sub>adj</sub>	0.028**						
<i>B. Sub-samples by Year of Observation</i>							
<b>Multiple</b>	<b>2000</b>	<b>2001</b>	<b>2002</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>
PB	0.172***	0.197**	0.302	0.540***	0.152**	0.255***	0.512**
PE	0.035**	0.072**	0.068	0.043***	0.046**	0.048**	0.045**
PS	0.123**	0.104**	0.174	0.119**	0.262**	0.131**	0.437**
EVS	0.101	0.273	0.266	0.124	0.196	0.107	0.156
EVB	0.223	0.278	0.166	0.175	0.244	0.149	0.231
EVEBITDA	0.393	0.303	0.112	0.037**	0.010**	0.090**	0.085**
EVEBIT	0.102	0.104	0.189	0.039**	0.111	0.104	0.136
EVFCF	0.078***	0.087**	0.178**	0.061**	0.020**	0.045**	0.078**
EVS <sub>adj</sub>	0.190	0.106	0.275	0.195	0.211	0.183	0.234
EVB <sub>adj</sub>	0.215	0.355	0.232	0.135	0.117	0.323	0.210
EVEBITDA <sub>adj</sub>	0.178	0.111	0.241	0.010**	0.007**	0.072**	0.046**
EVEBIT <sub>adj</sub>	0.287	0.171	0.348	0.062**	0.118	0.169	0.275
EVFCF <sub>adj</sub>	0.055**	0.079**	0.141**	0.045**	0.015**	0.049**	0.214**

\*\* significant at the 5% level  
 \*\*\* significant at the 10% level

In general, the evaluation by multiple seems to have greater efficiency (higher concentration of VE not significantly different from zero) in the industrial sector and in banks/insurance/real estate activities. The results for business type (Table 8 – Panel A) show the following trends:

1. In the **industrial sector**, between multiples on earnings, the PE is not significant; multiples EVEBITDA (adjusted and not) and EVEBIT – less sensitive accounting principles – lead to

good valuation; the multiples based on cash flows are next to zero, while those based on book value do not seem to have meaning.

2. For **banks, insurance and real estate firms**, the multiples based on book value (PB, EVB and EVB<sub>adj</sub>) and those based on cash flow (EVFCF and EVFCF<sub>adj</sub>) are significant. The multiples based on earnings do not show VE next to zero. The meaning of traditional measures of

profit for these firms is different than that for industrial firms. In fact, finance practitioners often seek indicators with more significance in their performance. For example, banks usually take the brokerage margin into account.

3. In the **energy sector**, only the EVB is significant, while in the services sector both the PE and EVFCF are significant. As a general observation regarding the energy sector, the scarce significance of

all the multiples supports the use of extra accounting indicators which enable to distinguish the phase of the energy generation, from that of transmission and sale. Examples are the installed capacity, the energy supplied, and the number of customers. The same may apply to services companies; for example, the number of customers served may be indicative of distribution capacity.

**Table 8.** VE Mean for Business Type

A. Sub-samples by Business Type (ATECO 2002)					
Multiple	Industrial	Energy	Services	Banks/Insurance/Real-estate activities	
PB	0.1949	0.2172	0.4990	0.0657	
PE	0.2079	0.1278	0.0702**	0.6764	
PS	0.3302	0.1699	1.2875	1.2222	
EVS	0.1596	0.1308	1.0279	0.8851	
EVB	0.1574	0.0056***	0.3858	0.1577	
EVEBITDA	0.0782**	0.1046	0.3763	0.6473	
EVEBIT	0.0803**	0.3617	0.2116	0.1536	
EVFCF	0.0874**	0.1860	0.0123***	0.0954**	
EVS <sub>adi</sub>	0.1545	0.1362	1.0420	0.8789	
EVB <sub>adi</sub>	0.1695	0.1154	0.4261	0.0132**	
EVEBITDA <sub>adi</sub>	0.0616**	0.2133	0.3800	0.6656	
EVEBIT <sub>adi</sub>	0.2513	0.3633	0.1290	0.1394	
EVFCF <sub>adi</sub>	0.0965**	0.2849	0.1717	0.0104**	
B. Sub-samples by Business Type (PAVITT Taxonomy)					
Multiple	Non-industrial	Traditional	Scale economy	High specialization	High technology
PB	0.6317**	0.1257	0.0429**	0.1548	0.6348
PE	0.1351	0.0447**	0.1447	0.0775**	0.1428**
PS	1.3993	0.3403	0.3874	0.2948	0.5691
EVS	1.0987	0.1208	0.2524	0.1434	0.3051
EVB	0.3989**	0.1189	0.0479**	0.0539	0.1502
EVEBITDA	0.5048	0.0275***	0.1445	0.0180**	0.0504**
EVEBIT	0.2556	0.0106***	0.0461	0.0289***	0.0660***
EVFCF	0.0276**	0.0807**	0.1909	0.0407**	0.4101**
EVS <sub>adi</sub>	1.1047	0.1218	0.2459	0.1542	0.3124
EVB <sub>adi</sub>	0.4496	0.0222	0.0561**	0.1658	0.1890
EVEBITDA <sub>adi</sub>	0.5071	0.0779**	0.1107	0.2931	0.1933
EVEBIT <sub>adi</sub>	0.2058	0.0615***	0.0387	0.2751	0.7565
EVFCF <sub>adi</sub>	0.0344**	0.2010**	0.2909	0.0237**	0.4382

\*\* significant at the 5% level  
 \*\*\* significant at the 10% level

As regards the results for different groups in PAVITT taxonomy (Table 8 – Panel B), the multiples based on earnings seem to be more effective in the industrial sectors and among those in the traditional sectors, in sectors with high specialization and high technology. Among the multiples based on earnings, those based on EBIT and EBITDA seem to have a minor VE compared to those based on EPS because they are less influenced by the adopted accounting policies. Multiples based on cash flows are effective in all sectors, except in the scale economy and high-technology sectors. Multiples based on book value are significant in non-industrial sectors and in scale economy.

These results confirmed the work of Meitner (2003). In his work, he explains when multiples based on earnings are more effective than those based on book value in three dimensions: access to external financial sources, size of intangible assets, and sector penetrability.

Regarding the PAVITT taxonomy, remember that each grouping is characterized by internal regularity concerning innovation, intensity of entrance barriers, and company size. In particular, the innovation is greater in the high specialization and high technology sectors (generally product and process innovation, which often translate to a greater weight on intangible assets) than in traditional sectors (innovation mainly means lower costs). The intensity entrance barriers are also greater in high-specialization and high-technology sectors than in traditional sectors. However, the average company size is smaller in traditional and high-specialization sectors than in high-technology sectors.

Maitner argues that if a company does not possess the possibility of access to the debt market, its growth is possible only if its investments are profitable or its current and future earnings are positive. As a result, the amount of earnings is a right proxy for growth opportunities, and a multiple based on earnings is appropriate in this context. On the

contrary, earnings are not necessarily a just proxy for future performance if the firm can count on external financing. Generally, the average company size is a discriminating factor of greater or lesser external financial company capacity. For example, smaller companies have less access to debt market and often prefer self-financing. The observation of the average firm size of the sample analyzed here reflects this conclusion. This justifies the results in both traditional and high-specialization sectors, where average company size (derived from sales and number of employees) is smaller. In these cases, for multiples based on earnings, the VEs are not significantly different from zero.

Another of Maitner's conclusions, consistent with the results obtained, is that firms with intangible assets (in this case, high-specialization and high-technology sectors) should be assessed using earnings-based multiples. This is due to the fact that not all value is incorporated by the book value. Thus, multiples based on book value are not able to express the capacity to produce future cash flows. Of course, for firms with less intangible assets (scale economy)

the book value is significant and may therefore be preferred.

The third dimension to consider is the degree of competition, because this is crucial for the opportunity to produce extra profits in the long term. In competitive markets, the extra profits should be zero; but in markets with high barriers (high-specialization and high-technology sectors), where the degree of competition is low, firms are able to accrue extra profits and their current earnings are a good indicator of future performance. Obviously, firms operating in a sector with low entrance barriers (scale economy) are preferably evaluated by using multiples based on book value.

Analyzing the efficacy of the various multiples in relation to the average company size (Tables 10 – Panel A and B), one can see how the multiples based on cash flows always lead to good estimates of value. For those based on earnings, the PE is always effective, while EVEBITDA and EVEBIT lead to good valuation of small firms. For the larger firms, the PB or the EVB is also significant. In general, it should be noted that VE is higher for smaller companies.

**Table 9.** VE Mean by Firm Size

<i>A. Sub-samples by Sales (€)</i>				
<b>Multiple</b>	<b>up to 25 million</b>	<b>from 25 to 250 million</b>	<b>over 250 million</b>	
PB	0.1643	0.4237**	0.3000**	
PE	0.0912**	0.0143**	0.0131**	
PS	0.2376	0.5922	1.1619	
EVS	0.3811	0.4445	0.8018	
EVB	0.7168	0.1419	0.0219**	
EVEBITDA	0.0473**	0.2094	0.4438	
EVEBIT	0.0464***	0.2609	0.3039	
EVFCF	0.0807**	0.0462**	0.0302**	
EVS <sub>adj</sub>	0.1929	0.4415	0.7960	
EVB <sub>adj</sub>	0.3248	0.1769	0.1640**	
EVEBITDA <sub>adj</sub>	0.2640	0.2126	0.3992	
EVEBIT <sub>adj</sub>	0.4460	0.2760	0.3015	
EVFCF <sub>adj</sub>	0.0446**	0.0297**	0.0142**	
<i>B. Sub-samples by Number of Employees</i>				
<b>Multiple</b>	<b>up to 50</b>	<b>from 51 to 250</b>	<b>from 251 to 500</b>	<b>over 500</b>
PB	0.4049	0.3663	0.1818***	0.1037**
PE	0.1248**	0.0974**	0.0547**	0.0644**
PS	0.2717	0.6171	0.5544	0.8838
EVS	0.3804	0.5504	0.4084	0.5760
EVB	0.2570	0.1896	0.0918	0.1847
EVEBITDA	0.0864**	0.0376**	0.2084	0.3817
EVEBIT	0.0977***	0.4099	0.0836***	0.3526
EVFCF	0.0902**	0.0784***	0.0168**	0.0655***
EVS <sub>adj</sub>	0.3939	0.5984	0.4013	0.5692
EVB <sub>adj</sub>	0.3560	0.2159	0.1238	0.1265***
EVEBITDA <sub>adj</sub>	0.3603	0.1273	0.1827	0.3450
EVEBIT <sub>adj</sub>	0.8786	0.2890	0.1471	0.3416
EVFCF <sub>adj</sub>	0.2139**	0.1045**	0.1042**	0.0990**

\*\* significant at the 5% level  
 \*\*\* significant at the 10% level

#### 4. Final Considerations

In this work, I investigated which selection criteria of comparables and which method of averaging leads to more accurate valuation for Italian firms. I also considered which multiple, among those most commonly used in financial practices, is the most effective in assessment. The aim of this study is to push for more systematic evaluation through multiples. The approach adopted was to compare the observed value with estimated value through comparable multiples for firms which belong to the same target sector, and/or were similar in terms of size and/or profitability.

The analysis carried out produced varying results.

In the first place, in the assessment by market multiples, the errors are next to zero (statistically significant) if one calculates the comparable value with median of comparables multiples, rather arithmetic or harmonic mean. This is true regardless of the multiple used.

Secondly, the evaluations are not accurate if one chooses the comparable by sector alone, or by size and profitability jointly. On the contrary, so as not to commit significant errors in valuation, one must also take profitability or size into account, besides the sector. In particular, the criteria “sector and profitability” seems better in valuation through earnings and sales multiples; using multiple of book value or cash flow, the criterion “sector and size” seems better.

Lastly, as regards the comparison between multiples, some conclusions are listed below.

- Multiples based on cash flows are almost always significant. They are effective in all sectors, except in the scale economy and high-technology sectors.
- Earnings multiples are more significant in the industrial sector; in particular, among earnings multiples, EVBTDA and EVEBIT lead to often low valuation errors for smaller firms or those with many intangible assets. They also seem to be more effective in the industrial and traditional sectors than in sectors with high specialization and high technology.
- Multiples based on book value appear more effective for banks, insurance, real estate companies – in general, for non-industrial firms. They are significant in non-industrial sectors and in scale economy.
- Cash adjusting does not lead to significant differences in terms of VE.

These results confirmed the work of Meitner (2003). He outlines three dimensions (access to external financial sources, size of intangible assets, and sector penetrability) when multiples based on earnings will be more effective than those based on book value.

I would like to stress here that the results obtained or those offered by international empirical literature, are not to be read as desiring to affirm the existence of an “optimal” approach in the valuation by multiples, but instead as the possibility of giving strength, by empirical data, to statements spread throughout theoretical literature.

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<sup>[i]</sup> The eight independent variables are the average of multiples for a group of comparables defined on the basis of sector, a proxy of extra-profit relative to sector, a proxy of extra-profit relative to I/B/E/S consensus earnings, leverage, ROA, ROE, research and development, payout.

<sup>[ii]</sup> The enterprise value is adjusted for cash by subtracting the voice cash and equivalent. The correction is justified on two grounds: firstly, there is no reason to undertake evaluations on cash, for this does not respect the distinction between book and market value; secondly, since the multiples based on earnings and sales do not take liquidity into account, when using them there is a risk of underestimating valuable firms with a large liquidity.

<sup>[iii]</sup> The statistical significance of the difference from zero of the average value of VE was tested by the one-sample T test. A paired-samples T test was used in the case of comparisons between means or evaluation of the significance of their difference.

<sup>[iv]</sup> The PAVITT taxonomy is a classification of merchandise categories drawn up on the basis of the sources and the nature of technological opportunities and innovations, research and development intensity, and the types of knowledge flows (know-how). Within the industrial sector the traditional industries (textiles, footwear, food and beverages, paper and printing, wood) are distinguished from those industries which are scale intensive (motor-vehicles, trailers and semitrailers), high-specialization industries (machinery and equipment, office, accounting and computing machinery, medical, precision, and optical instruments), and high-technology industries (chemical, pharmaceutical, electronics).

<sup>[v]</sup> Collection of data is done on June 30 of each year; on this date all the information of the previous year's balance is considered publicly available.

<sup>[vi]</sup> In the comparison between means, the details are not always statistically significant when you compare the selection criterion PROF+SIZE with the others, or you compare different methods of averaging. Using the PROF+SIZE criterion the average VE values are not significant. For these reasons, tables 6 and 7 do not contain relative data.