

The Accuracy of Multiples

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Abstract: Problem statement: Equity valuation with the use of multiples is widely used by academics and practitioners concerning its functionality. This study aims to explore the sensitivity of three multiples in terms of accuracy. **Approach:** Price-to-Sales (P/S) multiple, the price-to-book value of equity (P/B) multiple and the Price-to-Earnings (P/E) multiple are three multiples under consideration, using both current and one-year-ahead earnings forecasts. **Results:** Evidence of empirical results show that, the multiples P/mdfy1 and P/mnfy1 are effective in terms of accuracy, with their means being negatively biased and their medians being positively biased. Finally, current earnings are identified as more appropriate value driver for the calculation of the P/E ratio by terms of accuracy. The results can be considered as reliable owing to the large sample and the procedure followed for its selection. **Conclusion:** This study offers a better understanding of the valuation approach through the use of multiples, in order analysts assumption to be more carefully and properly chosen and their results to be more accurately produced.

Key words: Equity valuation, multiples under accuracy, value relevance, Residual Income Valuation Model (RIVM), accounting numbers, Price-To-Cash from Operations (P/CFO), comparable firms, sample selection

INTRODUCTION

Relativity and superiority are affected by many factors, such as accrual accounting, incremental values, liquidity constrains and conservatism. Moreover, value relevance and interpretation of accounting numbers may be unlike due to different practices (Bartov *et al.*, 2001).

Valuation or fundamental analysis can be specified as a tool in order the health and financial position of the firm to be explained. It should be cited, that the acceptance of a valuation method must surpass the cost of its use. The lack of certainty and imperfectness of the markets increases the need for accounting numbers (Burgstahler and Dichev, 1997).

Furthermore, the ultimate stage of a firms' predictive analysis, can be achieved by transforming an analyst's provision or a firm's component into value (Palepu *et al.*, 2003).

Most of the valuation methods have a strong connectedness with accounting numbers, more specifically, Residual Income Valuation Model (RIVM) or Abnormal Earnings (AE), Discounted Cash Flows (DCF), Dividend Discount Model (DIVM) and valuation through multiples which constitutes the basis

of the present study. The simplicity of multiples makes them widely attractive to academics and practitioners (Lie and Lie, 2002). Price-to-earnings (P/E), price-to sales (P/S), Price-to-Book value (P/B) and Price-to-Cash from Operations (P/CFO) are considered to be the most prevalent multiples.

This study deals with the accuracy of the Price-to-Sale (P/S) multiple, price-to-book value of equity (P/B) multiple, Price-to-Earnings (P/E) multiple with the use of both current and one-year ahead earnings forecasts (that is, price to current EPS, price to mean of one-year-ahead earnings forecasts and price to median of one-year-ahead forecasts). The primary objective is to investigate the relative performance of the above three multiples.

For this intention, the initial sample of 5,987 firms concluded in a sample of 3,572 US listed companies due to the application of a number of filters. A number of parametric tests were performed so as a time-series analysis of the abovementioned multiples to be carried out. Supplementary, it was tested statistically whether the real price was significantly different from the average intrinsic value and T-test analysis and regression analysis were conducted at 5% level of significance.

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The aim of the present study is to help analysts in choosing properly the best assumption and produce better and more accurate results. Proper assumptions and accurate results produced by multiple-based valuation method excite the interest of many parties, inside and outside the firm; in strategic planning, there is an influence in the way value is affected by larger set of actions; potential acquirers combined with investment bankers are interested in accurate and properly produced firm-value estimations and the synergies that such an estimation may present. Furthermore, credit analysts are interested in accurate results too, owing to the fact that a proper assumption and an accurate valuation of the firm will lead to a better sense of the risk that is associated with the lending activity.

To sum up, apart from the closely related group of people, a proper assumption and accurate results may yield a more useful valuation related with Initial Price Offerings (IPO), Seasoned Equity Offerings (SEO), leverage buy-out transactions and other activities associated with merger and acquisition (M and A).

Literature review: Value relevance of accounting measures: The value relevance term, is used with reference to the sufficiency of the summary accounting numbers in order to achieve the underlying economic value of the firm which we measure through current stock prices. In the foretime, value relevance issues have been examined by researchers through the use of levels (prices) or changes (returns) reports (Athianos *et al.*, 2005; Athianos and Vasakidis, 2006; Vasakidis and Athianos, 2010). Kothari and Zimmerman (1995) mentioned that the return specification is less convenient than the price specification. Moreover, price specification is capable of measuring the value relevance of both the flow (net income or earnings) and the stock (book value) variables. The IASs are assumed to have the possibility of harmonization (Athianos *et al.*, 2007), by improving the value relevance of book values at the expense of net income. On the other hand, price specification disadvantage is the vulnerability to econometric problems, derived from heteroskedasticity and scale bias (Kothari and Zimmerman, 1995).

There is a growing literature among academics over the theoretical links between the two branches (Richardson and Tinaikar, 2004). Examining of the value relevance of historical earnings and book values and which one should be most appropriately used, they find that earnings and book values are supplementary due to the fact that most models assume market efficiency.

On the other hand Burgstahler and Dichev (1997) avoid assuming market efficiency to enhance the

soundness of their results. They argue that since markets are imperfect accounting numbers are very important and more specifically earnings are used when a firm continues its normal operations and book value in case of using the capital in alternative ways.

According to Lee (1999), future is uncertain, leading to making educated guesses over the pending accounting numbers to unlock value relevant information. He introduces a combination of accounting information to enhance its value relevance and he takes one step forward of taking into consideration the analysts forecasts. As a result accounting systems are very important in valuation process because it provides a solid communication language.

Furthermore (Ohlson, 1995; Feltham and Ohlson, 1995; 1996) argue that historical earnings and book value are value relevant attracting thus much academic interest. Moreover they examine the value relevance of other accounting numbers such as dividends and next period's residual income concerning their value relevance. They find that both are explanatory variables of stock returns and thus value relevant. Easton and Harris (1991) argue that both earnings and earnings changes offer considerable value relevance and carry major explanatory power.

Multiples: A great advantage of multiple analysis stands in its simplicity. Only one number is required from investors, however that number is considered as a bottom line number on the balance sheet or the income statement and so it is regarded as a resource of remarkable amount of information. Although they are simple, the valuations are often approximations and they are considered as benchmarks.

On the other hand, according to Penman (2005), multiple analyses include also implementation problems. Although industry, product, size and some measures of risk are matched, it is almost impossible for two firms to be exactly the same. Moreover errors may arise by increasing the number of multiples, leaving too much space for "playing with mirrors".

Furthermore, Bhojraj and Lee (2002) state that there is little evidence according to the accounting and finance literature for the selection of specific multiples or certain comparable firms. It is suggested by practitioners, that due to the fact that the choice of comparable firms is "an art form" it should be left to professionals.

On the other hand, Simon (1997) argues that market-based multiples analysis is very popular owing to their function as a classic "satisfying" device. Furthermore, Bhojraj and Lee (2002) state that valuation with the use of multiples has as an advantage a more complete, but more complicated proforma analysis. The aim is to ensure a beneficiary

valuation heuristic that creates satisfactory results avoiding effort costs and extensive time. The failure of information that some multiples may fail to include can be balanced through the distinctive selection of comparable firms.

To sum up, another way of dealing with the problem of selecting comparable firms is to average across all firms in the industry. "The analyst implicitly hopes that the various source of non comparability cancel each other out, so that the firm being valued is comparable to a "typical" industry member. Another approach is to focus on only those firms within the industry that are most similar" (Palepu *et al.*, 2003).

Calculation of multiples: The most commonly used multiples are the Price-to-Earnings (P/E), the price-to-book value (P/B), the Price-to-Sales (P/S), the Price-to-Cash Flow from Operations (P/CFO). In order to evaluate the multiples, there are two methods that can be used; the method of multiple comparison analysis and multiple screening methods. According to multiple comparison analysis there are three steps that need to be followed. Firstly, identification of comparable firms that their operations are closely related to those of the target firm whose value is questionable. Secondly, identification of measures in the financial statement of the comparable firm, such as earnings, book value, sales, cash flows and calculation of multiples with those measures. Thirdly, application of the average or median of these multiples to the relative measure for the target firm, in order to get the value of the target firm (Penman, 2005).

MATERIALS AND METHODS

Sample selection: The sample constitutes by a set of US listed companies of all industries except financial industry. The initial sample consists of 5,987 firms. After applying a number of filters the sample was gradually reduced. Firstly, it was decided to include in the final sample only firms whose balance sheets' closing month was in December between 2001 and 2003. Secondly, it was decided to exclude those companies whose data regarding sale, EPS, forecasted EPS mean, median and book value were not available. Hence, the sample was reduced to 3,572 companies. Hereafter, the intrinsic values were calculated for the companies of the final sample. Since each multiple has different characteristics, with so rising and trimming was used for different multiples.

This sample was obtained by COMPUSTAT database, whereas the data regarding the cash flow

statements was derived from the I/B/E/S database and, as mentioned before, concerning the fiscal year 2001-2003.

In particular, for P/S and P/Book value, it was used 10% trimming of the top values so as to avoid negative prices. For the EPS, *mnfy1* and *mdfy1*, it was decided to exclude those firms with negative intrinsic value and also a 5% trimming was used to the top and bottom values of each one of them. The main reason for adopting such a method is to avoid extreme values resulting from high levels of profitability and sales.

Research and hypotheses development: This chapter consists of five subsections which describe the research methodology adopted. Specifically, this chapter includes the description of the research questions, the research paradigm, the research design, the sample selection and the definition of the comparable firms. Finally, it also provides some descriptive statistics for the value drivers of the sample.

Research questions: After taking into consideration prior research in the field of valuation methods and constructing the hypothesis of this study, a research question tries to address:

"Are the multiples effective in terms of accuracy?"

Research design: The multiple-based approach examined in this study is a relative valuation approach (Bhojraj and Lee, 2002). Even though literature suggests the use of harmonic mean in calculating the multiples owing to its superiority in comparison to median capitalization rate (Liu *et al.*, 2002; Beatty *et al.*, 1999), the present study employees the median.

The use of median capitalization rate was mainly decided so as to avoid a possible negative impact on the performance of multiples in case where harmonic mean was used instead. Besides, Alford (1992) uses the same method, that is, median capitalization rate, to lessen the impact of extreme multiples.

Current Earnings Per Share (EPS) and one-year-ahead earnings per share forecasts are selected as value drivers. Consequently, a valid comparison of the value relevance and actual performance of these value drivers is achieved. Liu *et al.* (2002) argue that longer forecast reflect more value relevant information. However, one-year-ahead EPS forecasts were employed instead of two-year-ahead EPS forecasts for simplicity reasons and owing to the sample size.

As for the collection of the data concerning current and forecasted EPS, it was conducted from Institutional Broker's Estimation System database (I/B/E/S). The variables which represent this multiples are actual and *mnfy1* and *mdfy1* respectively.

Since forecasted earnings are derived from different analysts, mnfy1 (mean) and mdfy1 (median) of all analyst's forecasts were employed in order to explore whether potential accuracy in earnings forecasts affect the results of the valuation.

According to Alford (1992), accuracy can be defined as the price scaled difference between the value estimate and the current security prices.

The estimation formula for accuracy is provided by Alford (1992) as follows:

Accuracy:

$$|e_{i,t}| = \left| \frac{V_t^E - P_{i,t}}{P_{i,t}} \right|$$

Alford (1992) regards accuracy as superior to bias as a performance metric due to the fact that an absolute prediction of errors weights equally positive and negative errors.

The third performance metric is explainability which is estimated by using time series regression analysis for contrasting intrinsic values against the realized security prices. The following equation was used for this purpose:

$$V_t = a_i + \beta_i P_i + \varepsilon_i$$

Where:

V_t = the intrinsic value of the i^{th} security

P = the realized security price

a_i = the intercept

β_i = the beta coefficient

RESULTS AND DISCUSSION

Descriptive statistic statistics of value drivers time-series security prices and P/B ratio after the 5% trimming used to the current EPS are reported in Table 1 Furthermore, a 10% trimming was used so as to avoid negatively skewed variables.

According to the figures presented in Table 1, all the variables are positively skewed with high levels of concentration as indicated by kurtosis. The mean and the median of the mean of on-year-ahead consensus analysts' forecasts and of the equivalent median are quite similar suggesting no bias in analysts' forecasts. Therefore, it is clear that no statistical difference is expected to exist, by choosing between the mean and the median of the earnings forecasts, regarding the performance of P/E multiple.

Multiples' evaluation in terms of accuracy: Two sample parametric t-test: Before analyzing the results regarding the evaluation of multiples under accuracy, it is essential to mention the results of the two-sample parametric t-test undertaken. The use of the parametric t-test enables the means of the intrinsic value and the stock price produced to be compared to each other. In particular, it is tested if there is a statistically significant difference between the two parameters and thus, if the stock price is under or overestimated.

The results of the two-sample parametric t-test of the multiples' means and medians, as illustrated in Table 2, suggest that among the five multiples under examination, the mean P/mdfy1 and the median P/S perform better; owing to the fact, that both multiples estimate the stock value well enough on average and their significance level suggests that on average the multiples does not misprice the stock (P/mdfy1: $p = 0.621$, P/S: $p = 0.407$; which are greater than 0.025 significance level).

As far as P/current EPS is concerned, the mean and the median of the multiple, indicate that the multiples systematically underestimated the stock value, due to the mean stock price which is greater than the mean intrinsic value. However, the difference between the means of the stock price and the intrinsic value of the mean P/current EPS multiple is not statistically significant since the p value equals 0.140 which is higher than the significance level. On the other hand, the median P/current EPS multiple has a statistically significant difference ($p < 0.0001$).

According to the mean P/mnfy1, it is implied that the multiple is systematically overestimating the stock value. Yet, the stock is not mispriced as shown by the significance level which is higher than the required one ($p = 0.062$). On the contrary, the median of the same multiple is systematically underestimating the stock, presenting a difference between the means which is statistically significant ($p < 0.025$ significance level).

Regarding the P/book value multiple, both the mean and the median of the particular multiple have the same performance. Specifically, the P/book value multiple is systematically overestimating the stock price, indicating a difference between the means of the stock price and the intrinsic value which is statistically significant ($p = 0.0001$).

Finally, the median of the P/mdfy1, as shown in Table 2, implies that the multiple systematically underestimated the stock value and that the difference among the means is statistically significant ($p < 0.025$ significance level). On the contrary, the mean P/S is overestimating the stock value systematically, but it has the same significant performance as the P/mdfy1.

Table 1: Descriptive statistics

Value drivers	Mean	Median	SD	Skewness	Kurtosis
Current EPS	0.529	0.660	3.171	6.661	196.150
Mdfy1	1.144	0.950	1.552	3.971	76.609
Mnfy1	1.145	0.960	1.548	4.007	76.010
Sales	3595.38	6880.83	11511.85	10.433	151.654
P4	24.418	19.950	28.213	16.635	360.467
P/B	3.528	1.987	34.173	52.745	2422.37

Notes: Current EPS: Current Earnings per Share as mentioned by DATA 58 in COMPUSTAT terms Mndfy1: the mean of one-year-ahead consensus analysts' forecasts in terms of I/B/E/S for each firm. Mdfy1: the median of one-year-ahead consensus analysts' forecasts in terms of I/B/E/S for each firm. Sales: net sales as mentioned by DATA 12 in COMPUSTAT terms P/B: the price-to-book ratio of each firm

Table 2: Two sample parametric t-test

Multiples	Mean of intrinsic value	Mean of stock price	P-value
Mean P/current EPS	26.526	27.347	0.1400
Median P/current EPS	22.976	28.216	<0.0001
Mean P/mdfy1	25.927	25.688	0.6210
Median P/mdfy1	24.630	26.280	0.0003
Mean P/mnfy1	26.482	25.563	0.0620
Median P/mnfy1	24.377	26.089	0.0002
Mean P/S	22.725	19.863	<0.0001
Median P/S	22.380	22.036	0.4070
Mean P/book value	53.710	18.210	<0.0001
Median P/book value	428.365	24.417	<0.0001

Table 3: Evaluation in terms of accuracy

Multiples	Mean of bias	P-value of t-test	Typical error
Mean P/current EPS	0.574	0.034	0.017
Median P/current EPS	0.481	0.021	0.011
Mean P/mdfy1	0.456	0.019	0.009
Median P/mdfy1	0.346	0.011	0.006
Mean P/mnfy1	0.458	0.018	0.009
Median P/mnfy1	0.352	0.012	0.006
Mean P/S	1.116	0.106	0.054
Median P/S	0.821	0.061	0.031
Mean P/book value	2.930	0.121	0.062
Median P/book value	26.225	2.841	1.449

Accuracy: In terms of accuracy, the results presented in Table 3 suggest that on average all the multiples are accurate and according to the t-test taken, the p-values are statistically significant for most of them. In contrast to bias, the multiples evaluated in terms of accuracy have a significance level higher than that used for the evaluation in terms of bias (Stauropoulos *et al.*, 2011). Specifically, the significance level for accuracy is equal to 0.05 or 5%.

Particularly the most accurate multiples are the P/current EPS, the P/mdfy1 and the P/mnfy1. The p-value of these multiples is greater than the significance level required and thus they are statistically significant. The above results imply that current EPS, mean of one-year-ahead forecasted earnings and the median of one-year-ahead forecasted earnings are better value drivers than sales and book value in terms of accuracy.

On the contrary, regarding the P/book value and the P/S multiple, it is mentioned that their p-values indicate that book value and sales are not accurate value drivers. Particularly, the p-value of the mean P/book value is equal to 0.121, which is greater than the significance level, indicating an inaccurate multiple. Similarly, the median P/book value has a greater p-value than the required one ($p = 2.481$), indicating that the p-value is statistically insignificant and the multiple is inaccurate.

Taking into consideration all the above, it is concluded that the results produced by the present study confirm the hypothesis. In particular, the results indicate that, overall, all the multiples under examination are effective in terms of accuracy. Furthermore, the empirical results of multiples evaluation indicate that the multiples P/current EPS, P/mdfy1 and P/mnfy1 perform better, in terms of accuracy, than the other multiples (Stauropoulos *et al.*, 2011).

The results regarding accuracy concur with the existing research. Lie and Lie (2002) suggest that the P/E multiple based on forecasted earnings provides more accurate estimates than other multiples. Furthermore, they imply that the price/sales multiple provides the least accurate estimates, something that is revealed also by the present study. Additionally, the empirical results of Liu *et al.* (2002), suggest that P/sales and P/book value perform relatively poor in terms of accuracy, are verified by this study.

Finally, the multiples' accuracy reveals that both current and forecasted earnings are equally good for the calculation of the P/E ratio.

The identification of current earnings as the best value driver for the P/E ratio by the terms of accuracy agrees with the results of Ou and Sepe (2002) who imply that current earnings is perceived by market participants as a good value indicator.

CONCLUSION

The results of the valuation of multiples in terms of accuracy suggested that the multiples price-to-current EPS, price-to-mdfy1 and price-to-mnfy1 (that is, price-to-earnings) performed better than the others. Owing to the fact that accuracy accepts more than one multiple as good performers, classification according to explainability would be perceptive for further research. Furthermore, current earnings are identified as more appropriate value driver for the calculation of the P/E ratio in terms of accuracy, which is in accordance with the results of Cheng and McNamara (2000). Finally, it can be concluded that, considering the large sample and the procedure followed for its selection, the results can be easily generalized and characterized as reliable.

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