INVESTORS BEHAVIOUR IN STOCK EXCHANGES BASED ON PRICE MULTIPLES AND VALUE DRIVERS, A CASE STUDY BASED ON COLOMBO STOCK EXCHANGE IN SRI LANKA

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Abstract

The main objective of this paper is to identify investor behaviour in the Colombo Stock Exchange by using price multiples and the corresponding value drivers. This study uses widely available and easily identifiable three price multiples (price earning, price to book value and price to sales ratios) and corresponding three value drivers (earnings per share, the net book value per share and sales). The main sources of data for this study are secondary data from the Colombo Stock Exchange and published Annual Reports of the 61 sample companies which covers 80% of the market capitalization. The regression analysis is used to forecast prices and obtained the pricing errors between the actual and forecasted prices. The main findings indicate that the net book value is the best value driver amongst all others for the entire market for investor behaviour. The best value driver is earning per share except for food, beverage and tobacco category. It is, therefore, recommended to use the net book value per share as the main value driver for the valuation of stocks in the Colombo Stock Exchange, except for food, beverage and tobacco sector companies.

Key words: Investor Behaviour, Colombo Stock Exchange: CSE, Price Multiples, Value Drivers, Sri Lanka.

1. Introduction

Once companies' securities are listed in stock exchanges then the trading of securities is possible from those respective stock exchanges. The functions of stockbrokers are to facilitate the investors the interface to the stock exchanges to carry out the trading of securities by executing the "buy" and "sell" orders and give financial advices to their clients. The return the Stockbroker's get is the brokerage fee that applies during each trading activity. Most of the instances the initial stocks are being issued off the stock exchange on primary markets and the investors have to instruct to deposit them to the stock exchange through their brokers for the subsequent trading. Therefore still it is possible to do trading without an involvement of a stock exchange that is known as off - exchange or trading over-the-counter. The investors in stock exchanges broadly categorise into either institutional or individual investors and local or foreign investors. Speculators are people who are interested in making a quick return based on rumours or prospects and who do not intend to hold onto stocks. Investor behaviour is a sum reflection of their activities and decisions on buying, selling or holding of stocks and securities. Most investors make their investment decisions based on many known and unknown internal and external factors. In this context, this study investigates the critical factors influencing investors' behaviour with respect to their investment decisions by comparing three fundamental measures,

namely earning per share, net book value per share and sales as a multiple of market price and their corresponding three value drivers (earnings per share, the net book value per share and sales).

2) Research Objectives

The main purpose of this study is to investigate the critical factors influencing investors with regards to their investment decisions by comparing three fundamental measures, namely earning per share, net book value per share and sales as a multiple of market price. Those three key performance price multiples are as follows: Price-to-Earnings, Price-to-Book value and Price-to-Sales. The primary objective is to identify which of the above price multiple is the best in the CSE for price evaluation on investment decisions. Finally, this study makes appropriate recommendations to relevant parties based on the results of the empirical analysis. This study will compare the three price multiples, namely the Price-to-Earnings (P/E) ratio, Price-to-Book (P/B) ratio and Price-to-Sale (P/S) ratio and try to establish the dominance of one over the other in context of the Colombo Stock Exchange. This study will test the following two hypotheses:

Hypotheses 1

H1: Historical Price multiples based on earnings provide more superior predictions than multiples based on book value and sales.

Hypotheses 2

H2: Forecasts from multiples when used within comparable firms are better than when used for the entire market.

2.0) Literature Review

Samarakoon (1997) had done a study on the cross-section of expected stock returns in Sri Lanka. Papadaki and Siougle (2007) studied on Value relevance of price, earnings and book values in the Athens Stock Exchange (ASE). Samarakoon (2003) examined Altman's Z-Score models of predicting corporate distress. Others who have studied various issues related to stock exchange operations include, Chaopricha and Chan (2010) who studied Thailand's stock market data, Maditinos, Sevic and Theriou (2009), Eljelly and Alghurair (2001)who did a study on performance measures and wealth creation in Saudi Arabia, Sehgal and Pandey (2009), Liu, Nissimand Thomas (2001), Baker and Ruback (1999), Fei (2011), Damodaran (2006), Herrmann and Richter (2003), Lie and Lie(2002),Schreiner and Spremann (2007), Schreiner (2007), Cheng and Mc Namara (2000), Parkand Lee (2003) , Maditinos (2007), Hettiarachchi (2009), Samarakoon (2009), Bandara and Samarakoon (2002). Other researchers include, Al-Ajmi (2008), Hyde (2007), Amarasiri (2007),Yatiwella and Silva (2011), Samarakoon (1996), Samarakoon (1998), Azizan and Mohamed (2010), and Sehgal and Pandey (2009,2010). Schreiner (2007) in his study on equity valuation using multiples found that support for the general perception that different industries are associated with different best multiples among trailing multiples, including forecast material reveals a clear dominance of the two-year forward-looking P/E multiple across industries. The results of the analysis of the properties and valuation accuracy of the two-factor multiples valuation model provide evidence for the theoretical reasoning that the usefulness of incorporating the P/B multiple as a second decision relevant multiple into the two factor model depends on: (1) its valuation accuracy in a specific industry; and (2) the exclusiveness of information provided over the first decision relevant multiple. Net Book Value, Invested Capital or Sales multiples generally lead to much smaller pricing accuracy than Earning based multiples, if relevant growth and profitability ratios are not controlled for, according to study by Herrmann and Richter (2003). This further confirms that sales multiples appear to be almost meaningless if comparisons are based on the industry classification alone. Schreiner (2007),

Schreiner and Spemann (2007) Park and Lee (2003), Liu, Nissim and Thomas (2001) are other researchers. Fei (2011) found that for the plantation sector the P/E multiple yields the most accurate valuation performance.

3.0) Methodology

This study is carried out through the secondary data from CSE website. The data set was selected by applying few screening criteria for all stocks listed during the period 2007 to 2011. The regression approach is used to forecast the price taking the value multiple as the gradient in the regression equation. In regression, both Ordinary Least Square (OLS) estimation and Generalised Least Square (GLS) estimations are used. GLS is used when there is significant heteroscedasticity in the forecast price errors. After deriving the forecasted prices the error components are analysed by using three techniques, namely, Root Mean Square of Errors (RMSE), Thail inequality coefficient and Wilcoxon test for the scaled absolute percentage errors. The lower of RMSE and the Tail Inequality coefficient is better model of prediction. Wilcoxon test will provide comparison with statistical significances. One of the important sources of data of the CSE is the data library. A data library is a compilation of the various databases of the CSE in Microsoft Excel format. It includes trading statistics of all listed securities, indices and periodical summary of market activities. The following files are used for the study:

-Quarterly Highest Lowest & Closing Share Prices: this file contains all the listed companies' High, Low, prices and the dates, closing prices, the number of trades and shares, turnover, the last traded date and number of days traded.

-Annual market capitalization of listed companies – this file gives each year's indexed number of shares, the last price and traded date and the market capitalization for all the listed companies of the CSE,

-The listed companies' annual and quarterly reports. The same market and company data from the listed company quarterly and annual financial statements are available in a summarised version from the Jafferjee Brothers Securities (2012, November) website available to members.

For this study, the large and most liquid shares are selected by using the following filtration criteria:

- Initially, the top 50 companies in terms of market capitalization are taken from the CSE.
- Next, companies added to the CSE during the last two years are removed. There, were four such companies.
- From the balance of the 50 companies of the top 100 in market capitalization, the companies that had an average daily trading of more than 100,000 Rupees during the past 20 quarters were selected.
- Sixty one companies constitute the final selection, which cover 80% of the market capitalization in the CSE.
- Yearly data are considered for the time period 2005 to 2011.
- Data records are removed if there is no data.If the EPS is negative or zero: the data point is taken as not applicable , Since the P/E has no meaning when EPS is zero or negative
- The sector selection:
- Same sector as per the CSE is used, if the base year (2005) has all the readings for all the companies of the sample selected and the numbers of companies in that sector is greater than 7.
- Rest of the companies are clubbed as "All other".

As per sector selection criteria three sectors are selected. Bank, Finance & Insurance (BFI); Beverages, Food & Tobacco (BFT);

Diversified (DIV) sectors are identified and rest of the companies are grouped as "All other".

Multiple valuation technique is the main analytical tool. In the methodology process,

there are three main areas covered; firstly to identify a benchmark multiplier technique which can be used to estimate peer companies in a comparable set of companies. Secondly, one of these techniques is used to forecast the price and compute the error of the forecasts. Finally, the three main value drivers considered in the study to create relevant multiples were used to compare the errors of forecasted price. Stand-alone price multiples were evaluated to find out which of the price multiple was most accurate. Historical prices were forecasted using three standalone value drivers, EPS, BV and Sales.

Benchmark Multiplier

There are three major approaches available are Gordon Growth Model (GGM) and Dividend Discount Model (DDM). Initially, calculation is done using GGM and DDM to estimate the market value of equity and derive the multiple with the book value of the driver of the multiples and find the justified multiple. It can also derive the forward and trailing multiple. Justified multiple can be used to compare the actuals and decide whether the current stock price is over or under priced (Fei, 2011). Therefore the multiple derived in this technique can be treated as a benchmark multiple; however, due to assumptions of justified multiple being linearly proportional to the value driver, there are weaknesses in this approach that also existed in Discounting Cash Flow model (Damodaran 2006, Schreiner and Spremann 2007). The other approach to estimate a benchmark multiple is based on the theoretical concept of the assumption that comparable firms have identical fundamentals such as risk, cash flow generation capacity and growth and hence that of multiples also would be same within a certain period (Damodaran 2006; Schreiner and Spremann 2007). Another possible approach to estimate a benchmark multiple is the multiple liner regression technique. In this technique, value drivers such as EPS and BV are considered as independent variables and the market price is taken as the dependent variable, the gradient then is given the benchmark multiple. These approaches can be considered as the main three approaches to derive the benchmark multiple. The third approach of liner regression technique is used in this study, since it examines the cross-sectional effect of the fundamental variable, (Fei, 2011). Besides, it is based on the actual data and the data is freely available in public domain.

Regression Analysis

In this methodology market regression is used. The price is forecast for each year by using the market regression. The market price is taken as the dependent variable and the value drivers (EPS, NBV and Sales) are taken as the independent variable. From the forecast price the pricing errors are calculated by subtracting the forecasted price from the actual price. In the regression procedure, the forecast price is computed using the Ordinary Least Square (OLS) estimation shown in the following equation (1), it has an intercept term.

$$\mathbf{p_{it} = \alpha_t + \beta_t . x_{it} + \varepsilon_{it}} \qquad \mathbf{(1)}$$

Where,
p_{it} = forecasted price for firm i in year t
α_t = intercept
x_{it}= value driver for firm i in year t
β_t = price multiple on the value driver
ε_{it} = pricing error

The intercept term, α_t captures the average effect of those factors which are not explained by the value driver. Many factors, besides the value driver under investigation, affect price and the average effect of such omitted factors is unlikely to be zero. Since the intercept in equation (1) captures the average effect of omitted factors, allowing for an intercept should improve the precision of out of sample predictions (Sehgaland Pandey, 2010).
The equation (1) is used for each year to perform the regression of the value driver and the price using the Ordinary Least Square estimates to derive the predicted price for each

year. The regression is done for each sector for each year among those companies within the sector. The errors are calculated as per below equation (2)

$$\varepsilon_{it} = p_{it} - \hat{p}_{it} \quad (2)$$

Where,
ε_{it} = pricing error
p_{it} = Actual price for firm i in year t
$\hat{p}_{it}$= forecasted price for firm i in year t

The validity of the OLS is checked to see if there is heteroscedasticity in error terms, by using White heteroscedasticity (no cross term) residual test. Since OLS is not applicable when there is significant heteroscedasticity, Generalise Least Square (GLS) estimation is used. This is done by dividing equation (1) by expected price $\hat{p}_{it}$, to improve the estimation efficiency as shown in the equation (3).

$$\frac{p_{it}}{\hat{p}_{it}} = \frac{\alpha_t}{\hat{p}_{it}} + \beta_t \frac{x_{it}}{\hat{p}_{it}} + \frac{\varepsilon_{it}}{\hat{p}_{it}} \quad (3)$$

As per Sehgaland Pandey (2010), estimating equation (3) with no restriction minimizes the square of pricing errors, but the expected value of these errors is non-zero. Empirically Liu, Nissim, and Thomas (2002) have proved that restrictions are imposed expecting pricing errors (E (ε /p)) to be zero, it generates lower pricing errors for most firms, relative to an unrestricted estimate, but it generates substantially higher errors in the tail of the distribution. As per Sehgal and Pandey (2010), by restricting unbiased pricing errors, it is in effect assigning lower weights to extreme pricing errors, relative to unrestricted approach. By doing so it also maintains consistency with the tradition in econometrics that strongly prefers un- bias over reduced dispersion. Therefore, it imposes the restriction that pricing errors be unbiased.

That is, to estimate the parameters subject to the restriction that expected value of the residual term is zero: α_t and β_t that minimize the variance of $\left(\frac{\varepsilon_{it}}{\hat{p}_{it}}\right)$, subject to the restriction that

expected value of the residual term is zero:

$$\min_{\alpha,\beta} var\left[\frac{\varepsilon_{it}}{\hat{p}_{it}}\right] = var\left[\frac{\hat{p}_{it}-\alpha_t-\beta_t x_{it}}{\hat{p}_{it}}\right]$$

$$= var\left(1 - \left[\alpha_t \frac{1}{\hat{p}_{it}} + \beta_t \frac{x_{it}}{\hat{p}_{it}}\right]\right) \quad (4a)$$

$$\text{s.t.} \quad E\left(\frac{\varepsilon_{it}}{\hat{p}_{it}}\right) = 0 \quad (4b)$$

α_t and β_t can be derived as follows that will satisfy the equation (4a) and (4b):

$$\beta_t = \frac{E\left[\frac{x_t}{\hat{p}_{it}}\right] var\left[\frac{1}{\hat{p}_{it}}\right] - cov\left[\frac{1}{\hat{p}_{it}}, \frac{x_t}{\hat{p}_{it}}\right] E\left[\frac{1}{\hat{p}_{it}}\right]}{E\left[\frac{1}{\hat{p}_{it}}\right]^2 var\left[\frac{x_t}{\hat{p}_{it}}\right] + E\left[\frac{x_t}{\hat{p}_{it}}\right]^2 var\left[\frac{1}{\hat{p}_{it}}\right] - 2E\left[\frac{1}{\hat{p}_{it}}\right] E\left[\frac{x_t}{\hat{p}_{it}}\right] cov\left[\frac{1}{\hat{p}_{it}}, \frac{x_t}{\hat{p}_{it}}\right]} \quad (5)$$

$$\alpha_t = \frac{1 - \beta_t E\left[\frac{x_t}{\hat{p}_{it}}\right]}{E\left[\frac{1}{\hat{p}_{it}}\right]} \quad (6)$$

Where,
$E[:::]$ - The means
$var[:::]$ - The variances
$cov[:::]$ - The covariance

After putting the-above said restriction, the forecasted prices are computed for each year through GLS estimation where White test has failed. The pricing errors are next estimated, defined by equation (7), where the pricing errors are the difference between actual and forecasted prices.

$$\frac{\varepsilon_{it}}{\hat{p}_{it}} = \frac{p_{it} - \hat{\alpha}_t - \hat{\beta}_t x_{it}}{\hat{p}_{it}} \quad (7)$$

This procedure is repeated for each sector for all the sample years and the pricing error is computed. It is also done for entire market taking into consideration all the sectors and the pricing errors were calculated for each value driver EPS, NBV and Sales separately.

Pricing Error Evaluation

The following three techniques are used to compare the prices and evaluate the best multiple that give the minimum error.

1. Root Mean Square Error (RMSE): Sehgaland Pandey (2010).
2. Thail Inequality Coefficient: Sehgaland

Pandey (2010).

3. Wilcoxon Test: Fei (2011).

Root Mean Square Error (RMSE)

As per Sehgal and Pandey (2010), Root Mean Squared Error depends on the scale of dependent variable. It is used as a relative measure to compare forecasts for the same series across different models. According to this criterion the smaller the error in a model, the better is the forecasting ability of that model. It is calculated as follows:

$$RMSE = \sqrt{\frac{\sum_{t=t+1}^{T+h}(y_t - \hat{y}_t)^2}{h}} \qquad (8)$$

Where,
y_t = Observed value
$\hat{y}_t$ = Forecasted value
h = number of observations

Thail Inequality Coefficient

As per Sehgal and Pandey (2010), Thail Inequality Coefficient is scale invariant. It always lies in between 0 and 1, where 0 indicates a perfect fit. It is estimated as follows:

$$Thail\ Inequality\ Coefficient = \frac{\sqrt{\frac{\sum_{t=t+1}^{T+h}(y_t - \hat{y}_t)^2}{h}}}{\sqrt{\frac{\sum_{t=t+1}^{T+h}(y_t)^2}{h}} + \sqrt{\frac{\sum_{t=t+1}^{T+h}(\hat{y}_t)^2}{h}}} \qquad (9)$$

Wilcoxon Test

Finally, as per Fei (2011), valuation error taken as the Scaled Absolute Error (SAE) as shown in the equation (10) below. Taking the predicted price as the scaling factor eliminates the problem of outlier in the actual price.

$$\left|\frac{\varepsilon_{it}}{\hat{p}_{it}}\right| = \left|\frac{p_{it} - \hat{p}_{it}}{\hat{p}_{it}}\right| \qquad (10)$$

Lower the SAE, better is the valuation accuracy among the multiples. The Wilcoxon Rank Sum test is used to give a statistical significance for comparison of the three different multiples to forecast; i.e. to identify which multiple gives the best or the statistically superior results by testing the scaled absolute errors of those multiples by the Wilcoxon tests. Wilcoxon value of less than 1.96 and p-value greater than 0.05 suggests that distribution of valuation errors is statistically indistinguishable at 95% significance level. Through these three measures, the market pricing errors are evaluated to define which price multiple is best for forecasting, based on minimum error criteria.

5.0) Data Analysis and Interpretation

Summary data of companies selected is shown below in Table 1.These selected companies cover 15 sectors of the CSE out of 20 sectors, which is 75% coverage in terms of number of sectors. The same sector was considered as in the CSE when the selected number of companies were more than or equal to 8 companies. Three sectors were identified: Bank, Finance & Insurance; Beverage, Food & Tobacco and Diversified sectors. These three sectors provide 42 companies and the balance 29 companies spread among 12 sectors were grouped as "all other" in this study.

Table 1: Number of Companies in Sector

	Sector Name	Number of Companies Listed	Number of Companies Selected	%age of Selection from the Existing	%age of Selection from the Selected
1.	Banks, Finance & Insurance	62	15	24%	25%
2.	Beverage, Food & Tobacco	22	8	36%	13%
3.	Construction & Engineering	6	1	17%	2%
4.	Chemicals & Pharmaceuticals	10	2	20%	3%
5.	Diversified Holdings	18	9	50%	15%
6.	Footwear and Textiles	5			
7.	Hotels and Travels	37	5	14%	8%
8.	Healthcare	6	3	50%	5%
9.	Investment Trusts	9	3	33%	5%
10.	Information Technology	2			
11.	Land and Property	20	1	5%	2%
12.	Manufacturing	38	5	13%	8%
13.	Motors	7	1	14%	2%
14.	Oil Palms	5	2	20%	3%
15.	Power and Energy	8	2	25%	3%
16.	Plantations	18			
17.	Stores and Supplies	5			
18.	Services	8			
19.	Telecommunication	2	2	100%	3%
20.	Trading	9	2	22%	3%
	Total	**297**	**61**	**21%**	**100%**

Source: CSE (2012) and Data analysis

5.1) Descriptive Statistics

Ideally there should have been 427 data points for each variable but due to the unavailability of some years' data, especially during 2006, a few data points were missing due to the unavailability of the annual reports of a few companies. Additionally, due to the invalid data available for analysis, the negative Earnings per Shares had no use for the price multiple, and those had been removed from the records as well. Finally there were 362 valid data points. The data records taken are: Earnings per Share (EPS), Net Book Value per Asset (NBV), Sales, Last Traded Price (Price) and Number of indexed shares. Table 4 gives the descriptive statistics of the data sample selected. The highest mean EPS 28.49 is recorded in Diversified Sector with a std. deviation of 55.88; the lowest mean EPS of 14.8 is recorded in all other grouped sectors with a standard deviation of 32.76 and in the entire sample, corresponding to the market the mean EPS is 18.98 with a standard deviation of 32.93. The highest mean NBV of 204.51 is also recorded in DIV sector while with a standard deviation of 377.94, the whole sample it is 119.89 with a standard deviation of 221.99.

Table 2. Descriptive Statistics – Sector wise

Grouped Sector		N	Minimum	Maximum	Mean	Std. Deviation
All Other	EPS	158	.05	289.19	14.8012	32.76170
	NBV	180	1.38	1995.38	99.1156	222.78003
	Sales	180	12187402	69074225000	10501306920.60	13878010159.455
	Price	180	1.30	3025.50	165.9289	396.97521
	Valid N (listwise)	158				
Banks, Finance and Insurance	EPS	100	.97	90.00	18.8975	15.24726
	NBV	100	9.72	536.83	123.9756	105.10653
	Sales	101	300134000	45465364000	13706749106.98	11765958910.264
	Price	101	10.25	1400.30	159.8114	198.93998
	Valid N (listwise)	99				
Grouped Sector		N	Minimum	Maximum	Mean	Std. Deviation
Beverage, Food and Tobacco	EPS	49	.90	83.53	21.6018	19.95920
	NBV	49	6.88	338.58	87.6927	86.21840
	Sales	49	3115853000	76150556000	23936910673.47	19707009802.117
	Price	49	22.50	889.00	250.9949	228.63395
	Valid N (listwise)	49				
Diversified Holdings	EPS	57	.87	325.24	28.4863	55.88058
	NBV	58	2.58	2013.28	204.5171	377.94813
	Sales	59	3317986000	605000068000	35353293853.75	77270,085,204
	Price	59	7.50	4500.00	427.7890	946.34984
	Valid N (list wise)	56				
Overall Sample – the market	EPS	364	.05	325.24	18.9850	32.93559
	NBV	387	1.38	2,013.28	119.8897	221.99126
	Sales	389	12,187,402	605,000,068,000	16,795,295,286	33834495375
	Price	389	1.30	4500.00	214.7724	481.87469
	Valid N (list wise)	362				

Source: SPSS analysed results

5.2) Overall Discussion

The methodology was applied for the sector wise data for the three value drivers (i.e. EPS, NBV and Sales) separately. Firstly the analysis was done for the EPS value driver .Initially the regression was done between EPS and Price for each year for each sector using SPSS. The forecast price and the pricing error are computed, where the regression EPS is the independent variable and the price is dependent variable. The regression is done using the "Liner Regression" option in the SPSS and results of the predicted and the error terms are saved from the SPSS. Then the errors are checked with the White test for heteroscedasticity.

To perform the White test, the following steps are followed:

1. Multiple regression is performed between the square of the errors as the dependent variable and the EPS^2& EPS as the dependent variables.
2. The R^2 of the above regression is obtained, and then the product $NR^2$is taken as the white test value.
3. This $NR^2$is compared with the Chi^2 test at 95% confidence interval with a degree of freedom of 2. (Degree of freedom is the number of independent variables in the regression explained in step 1 above), when the $NR^2$is greater than Chi^2, the white test has failed and there is a need to use the GLS for price estimations.

When the above mentioned White test has failed, the equation (5) and (6) is used to compute α and β. As per these equations, the mean, variance and covariance of terms 1/ price, 1/ $price^2$, EPS/price, $(EPS/price)^2$ are required. This means, variance and the co-variance are computed by using the "Descriptive" and the "Reliability Analysis: Statistic" options in SPSS. Then from equation (7), the error term is calculated by using the above derived α and β.This exercise is repeated for each year for each sector for driver EPS. White tests failed in year 2005, 2006 and 2008 of all other grouped sector and it's failed in 2005 and 2007 for diversified holdings sector. In these instances the GLS is used to derive the errors. Then the RMSE, the Thail coefficient are calculated as per the equations (8) and (9).Also the scaled absolute error is calculated as per the equation (10) to use the Wilcoxon test. Then this exercise is repeated with the other two value drivers NBV and Sales. In following instances the white test was failed for NBV; In grouped "all other" sectors all the years except 2007, in 2011 in BFI sector and in 2005, 2007 and 2009 in Diversified holdings sector the NBV the White test failed and followed the GLS to derive the errors in such instances. However the Sales passed all the white tests. The RMSE and the Thail coefficients are calculated and compared. Also the Scaled Absolute Errors of all the value drivers for each sector are tested using the Wilcoxon tests. All of the above steps are done to the market as a whole taking all the selected 61 companies as a whole.

5.3) Multiple Comparison in Sectors

After performing the above exercise the below are the summarised results as depicted in Table 3.

Table3. RMSE& Thail-Coefficient for Sectors – Overall comparison

RMSE	P/E	P/B	P/S
All Other	163.91	62.54	392.69
Banks, Finance and Insurance	119.23	79.58	179.04
Beverage, Food and Tobacco	150.76	170.68	184.06
Diversified Holdings	126.40	90.30	857.95

Thail Coefficient	P/E	P/B	P/S
All Other	0.19	0.07	0.65
Banks, Finance and Insurance	0.25	0.16	0.41
Beverage, Food and Tobacco	0.24	0.27	0.30
Diversified Holdings	0.06	0.05	0.54

Sources: Data analysed results

Table 4 shows the least RMSE is in the "All Other" grouped sector that gives the least error in forecasting price using the P/B multiple and as per the Thail coefficient Diversified Holdings sector gives the least error in forecasting price using the P/B multiple. Therefore, the Net Book Value is a better driver to forecast prices in Diversified and "All other" grouped sectors. It also shows that the P/B is better than the P/E and P/S in almost all the sectors except in the Beverages, Food and Tobacco (BFT) sector. Next we compare the P/E, P/B and P/S separately in each sector to identify the best to predict price. As depicted in table 6 below, none of the sectors will give a better forecasting with the P/S multiple, as it gives the highest error values in both RMS and Thail-Coefficients. Therefore P/S can be ruled out the as a good multiple in the CSE for forecasting. It further shows that the P/B is the best multiple in both RMS and Thail-Coefficients which gives the lowest error terms for all the sectors; however in the BFT sector, it is the P/E ratio which gives the lowest price errors in both RMS and Thail Coefficients.

Table 4. RMSE&Thail-Coefficient for sector - Driver in each Sector Comparison

RMSE	P/E	P/B	P/S
All Other	163.91	62.54	392.69
Banks, Finance and Insurance	119.23	79.58	179.04
Beverage, Food and Tobacco	150.76	170.68	184.06
Diversified Holdings	126.40	90.30	857.95

Thail Coefficient	P/E	P/B	P/S
All Other	0.19	0.07	0.65
Banks, Finance and Insurance	0.25	0.16	0.41
Beverage, Food and Tobacco	0.24	0.27	0.30
Diversified Holdings	0.06	0.05	0.54

Sources: Data analysed results

In the error analysis the third technique was to use the Wilcoxon test and it was performed to the sector analysis to identify the best value driver for forecasting the price and the Wilcoxon test results given in Table 5 below. It shows that in BFT sector, EPS is significantly better value driver than Sales at 95% confidence interval and EPS is significantly better value driver than NBV at 90% confidence interval for price forecasting using price multiples,

Table5. Wilcoxon Test Results for Sector

Test Statistics

GroupedSector		SAE-B - SAE-E	SAE-S - SAE-E	SAE-S - SAE-B
All Other	Z	-2.735[b]	**-6.856[c]**	**-7.304[c]**
	Asymp. Sig. (2-tailed)	.006	**.000**	**.000**
Banks, Finance and Insurance	Z	-1.829[b]	-1.843[c]	**-3.672[c]**
	Asymp. Sig. (2-tailed)	.067	.065	**.000**
Beverage, Food and Tobacco	Z	-2.671[c]	**-2.880[c]**	-1.149[c]
	Asymp. Sig. (2-tailed)	.008	**.004**	.251
Diversified Holdings	Z	-2.561[b]	**-3.589[c]**	**-4.902[c]**
	Asymp. Sig. (2-tailed)	.010	**.000**	**.000**

a. Wilcoxon Signed Ranks Test
b. Based on positive ranks.
c. Based on negative ranks.

Sources: SPSS Data analysed results

Furthermore, it shows that in Diversified and "All other" grouped sectors it is best forecasted and there is significance improvement on forecasting using NBV as the value driver over the EPS at 90% confidence level. However for the BFI sector it does not show a significance difference since the value is below 1.96 from the Wilcoxon test but the RMSE and Thail confirms that even BFI also better forecasted using NBV over EPS. In "all other" grouped

sector and the Diversified Holdings sector, the Wilcoxon test results shows that both EPS and NBV is significantly better than the Sales with 95% confidence interval whereas the BFT and BFI shows only one of the value driver is significantly better than the sales, that are EPS and NBV respectively better predicted than the sales value driver.

5.4) Multiple Comparison in Entire Market

Same analysis is done for all the 61 companies taken as a whole, and it will represent the entire market as it has 80% of the market capitalization. The results are shown in below Table 6.

Table 6. Entire market RMSE and Thail

Market	RMSE	Thail Coefficient
P/E	127.75	0.12
P/B	76.02	0.08
P/S	475.53	0.63

Sources: Data analysed results

Table 7 clearly shows that when the multiples are used as a whole to the market, the P/B ratio in other words the NBV as the value driver is shown as the best with the smallest RMSE and Thail Coefficient. And also it shows that the Sales is not a good value driver even for the entire market as a whole and recorded the highest errors in both RMSE and Thail coefficient. Furthermore, in accordance to the Wilcoxon test as per Table 9, it can be said that systematically P/B is the best compared to the P/E and P/S for forecasting when applied to the market with a 95% confidence level. Also shows that P/S is significantly poorer method than the P/E and P/B when used to the whole market as a whole.

Table 7. Wilcoxon Results for the market

Test Statistics

	MKT_SAE_B - MKT_SAE_E	MKT_SAE_S - MKT_SAE_E	MKT_SAE_S - MKT_SAE_B
Z	-4.446[b]	-13.249[c]	-13.636[c]
Asymp. Sig.(2-tailed)	.000	.000	.000

a. Wilcoxon Signed Ranks Test
b. Based on positive ranks.
c. Based on negative ranks.
Sources: SPSS Data analysed results

5.5) Comparison between Sectors and Market

In this section, the multiples usage comparison will be used to compare whole markets and sector base usage. The RMS and Thail-Coefficients given in table 8 are used in the market and sector wise comparisons. It shows that the P/B and P/E have the lowest error terms in both RMSE and Thail coefficient when used in market regression than in sector regression. However the P/S has larger value in RMSE and Thail-Coefficient but it is a lower error terms when used in sector wise regression. However since sales as the value driver has the largest values for both RMSE and Thail coefficient amongst all the value driver results, it is not the best to use even either market or sector regression methods.

Table 8. Multiples in Sector vs. Market

	RMSE			Thail-Coefficient		
	P/E	P/B	P/S	P/E	P/B	P/S
Market	127.75	76.02	475.53	0.12	0.08	0.63
Sector	145.35	91.47	442.25	0.14	0.10	0.54

Sources: Data analysed results

Same results are shown from the Wilcoxon test as well. The results are given in the Table 9 to 11. It shows that there is systematically significant lower error when used market regression over sector regression with 95% confidence level when used the EPS and the NBV value drivers for forecasting. Similar to the RMSE and Thail coefficient in Wilcoxon test also the sales shows at lower confidence interval the sector regression has lower error than the sector regression.

Table 9. P/E in Sector vs Market

Test Statistics

	SAE_E_Sector - SAE_E_Market
Z	-7.216[b]
Asymp. Sig. (2-tailed)	.000

a. Wilcoxon Signed Ranks Test
b. Based on negative ranks.
Sources: SPSS Data analysed results

Table 10. P/B in Sector vs Market

Test Statistics[a]

	SAE_B_Sector - SAE_B_ Market
Z	-6.957[b]
Asymp. Sig. (2-tailed)	.000

a. Wilcoxon Signed Ranks Test
b. Based on negative ranks.
Sources: SPSS Data analysed results

Table 11. P/S in Sector vs Market

Test Statistics[a]

	SAE_S_sector - SAE_S_ Market
Z	-2.700[b]
Asymp. Sig. (2-tailed)	.007

a. Wilcoxon Signed Ranks Test
b. Based on positive ranks.
Sources: SPSS Data analysed results

5.0) Finding and Policy Recommendations

5.1) Findings

The primary objective of this study is to determine which multiple amongst the price earning (P/E), price to book value (P/B) and price to sales ratios (P/S), will give a better equity valuation. The study found that Net Book Value (NBV) is the best value driver to forecast in the CSE as a whole and sector wise, in most of the sectors including Banks, Finance and Insurance; Diversified Holdings. NBV gives better price forecast in most of the Asian countries as per the previous studied by Sehgal and Pandey (2010) and Park and Lee (2003). However the Beverage, Food and Tobacco sector showed that the Earnings Per Share (EPS) is the best value driver to predict in all the performance evaluation criteria tested in the study. This confirms the popular perception that different industry will have their own best value driver (Liu, Nissim and Thomas, 2001).Beverage, Food and Tobacco has the EPS as the best value driver and Diversified Holdings and Banks, Finance and Insurance sectors have the NBV as the best value driver. However since the other sectors in the CSE have less number of companies, it was not possible to investigate the other different industries, separately, and not included in this study. The same result was observed by Herrmann and Richter (2003). In the analysis, the market as a whole is better predicted than the sector wise for EPS and NBV. Similar result was observed by Sehgal and Pandey (2010). However the sales as a value driver showed a poor performance and at low confidence when used in market regression than when used in sector regression. Therefore both the hypothesis is rejected. Hypothesis one was valid only for the Beverage, Food and Tobacco sector. All other sectors and the entire market, shows that price multiple bases on book value provide superior prediction than earning or sales based multiples in forecasting share price in the CSE. In case of second hypothesis, the finding show that market regression prediction is much better than for comparable companies, for EPS and NBV multiples.

5.2) Recommendations

The results obtained through the data analysis are very robust and statistically significant. Furthermore, the error results are analysed using three main techniques namely the RMSE, Thail Coefficient and the Wilcoxon test that covers all the aspect to analyse the test results. These novel findings will be a very valuable knowledge to the stock market investors, and will be useful for investors to make sound investment decisions. It can be recommended that: Earnings per Share as the value driver to be used when evaluating or forecasting companies in Beverage, Food and Tobacco sector in the Colombo Stock Exchange. Use of market regression approach and the Net Book Value as the value driver to evaluate stocks in the Colombo Stock Exchange is recommended.

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