A Statistical Inquiry into the Correlation of Income and Balance Sheet Metrics on Equity Valuation

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Financial analysts, portfolio managers and investment bankers seeking to assess over- or undervaluation of securities often use metrics such as price to earnings, price to cash flow, price to sales, price to book value ratios and others. Time series correlations of equity price to earnings per share, cash flow per share and book value per share is analyzed for 1500 companies. Book value per share appears to have the highest correlation in the aggregate, on a sector basis and on a market capitalization basis.

INTRODUCTION

Financial analysts, portfolio managers and investment bankers seeking to assess over- or undervaluation of securities often use metrics such as price to earnings, price to cash flow, price to sales, price to book value ratios and others. For the same company or sector, some analysts use one, others use a different, and others use several of these.

This research undertakes to measure correlations between price per share and these per share ratios to assess which have greatest efficacy, and what factors, i.e. size, risk, sector, or industry would lead to the optimal use of one correlation over another. The conclusions herein should be of interest to many participants in financial services.

METHODOLOGY

Panel data was downloaded from FactSet for years 1999-2015 for those companies that were constituents of the SP1500 as of 12/31/2015. Therefore 22,500 observations were obtained. Price and market value were as taken as of 12/31, while earnings per share (eps), cash flow per share (cfps) and book values per share (bvps) were taken as of the end of the fiscal year. Indicator variables (0/1) were included to indicate the company's inclusion in the SP500 (large cap), SP400 (midcap), or SP600 (small cap) indexes. Analytical methods, i.e. descriptive statistics and correlation, as well as scatterplots are used to make inferences and obtain conclusions about efficacy of the correlations regarding valuation.

RESULTS

Table 1 displays raw data for the 10 companies with the highest market values as of 12/13/2015. The full table of raw data appears in Appendix I.

TABLE 1
PRICE AND PER-SHARE RATIOS BY COMPANY

Company	Sector	Mkt.Val	price	eps	cfps	bvps	year
Apple Inc.	Information Technology	647,361	105.26	9.22	13.97	21.39	2015
Exxon Mobil Corporation	Energy	391,482	77.95	3.85	11.30	41.10	2015
Microsoft Corporation	Information Technology	382,881	55.48	1.48	3.52	9.98	2015
Berkshire Hathaway Inc. Class B	Financials	370,604	132.04	9.77		103.67	2015
Alphabet Inc. Class A	Information Technology	329,769	778.01	22.84	32.57	175.07	2015
Alphabet Inc. Class C	Information Technology	329,769	758.88	22.84	32.57	175.07	2015
Johnson & Johnson	Health Care	292,703	102.72	5.48	5.83	25.82	2015
Wells Fargo & Company	Financials	284,386	54.36	4.12		33.54	2015
Wal-Mart Stores, Inc.	Consumer Staples	276,808	61.30	5.05	8.23	25.21	2015
General Electric Company	Industrials	253,766	31.15	0.15	2.60	10.48	2015
Procter & Gamble Company	Consumer Staples	246,136	79.41	2.42	5.07	22.60	2015
JPMorgan Chase & Co.	Financials	233,936	66.03	6.00		60.46	2015
Chevron Corporation	Energy	212,068	89.96	2.45	16.87	81.11	2015
Oracle Corporation	Information Technology	197,480	36.53	2.21	3.18	11.20	2015

SCATTERPLOTS AND CORRELATIONS

Figs. 1-9 display scatterplots of price v. eps, cfps, and bvps with correlations noted for ExxonMobil, Federal Express and American Micro Devices with robust linear regression lines overlaid on the data. Data points above the line *could* be indicative overvaluation and data points below the line indicative of undervaluation. Notice that significant outliers could exist in either the x or y space. Hence robust, as opposed to ordinary least squares, regression lines are overlaid on the graphs. Importantly, it is probable that the over- or undervalue signals given by the different metrics could conflict. Even if the signals do not conflict, the relative over- or undervaluation (relative to other securities) could drastically differ depending on choice of metric.

FIGURE 1
SCATTERPLOTS AND CORRELATIONS

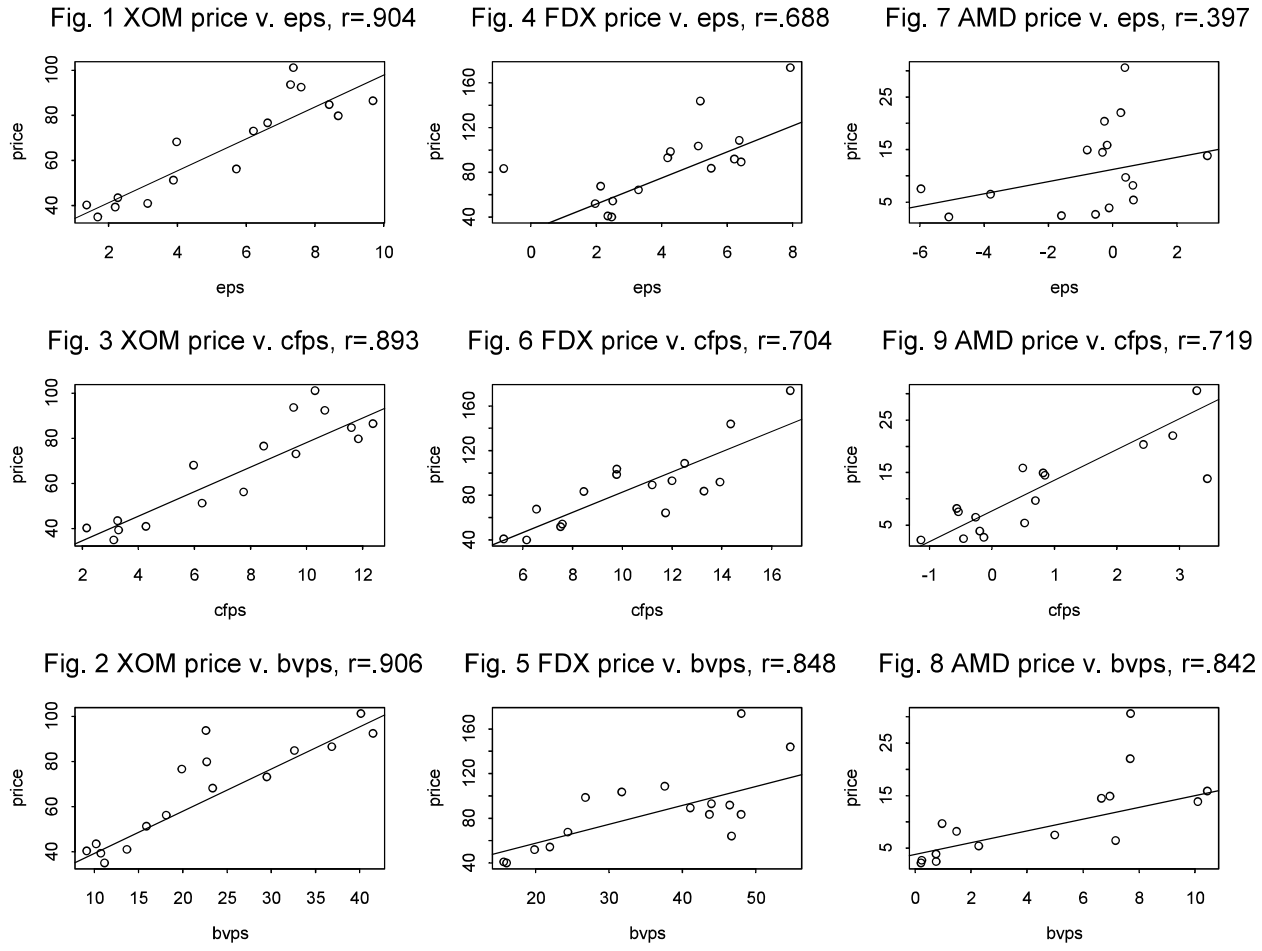

Table 2 displays the correlations for the 3 companies in tabular form. Note that bvps has the highest correlation with price for all 3 companies. The premise on correlating price to earnings, cash flow and book value per share is that use of one versus the other might result in superior asset selection and performance for a portfolio.

TABLE 2
EPS, CFPS AND BVPS BY COMPANY

Ticker	Company	Sector	Sample Size	Eps	Cfps	bvps
XOM	Exxon Corp.	Energy	20	0.904	0.893	0.906
FDX	Federal Express	Industrials	19	0.688	0.704	0.848
AMD	Advanced Micro Devices	Information Technology	19	0.397	0.719	0.842

The full table of correlations for 1500 companies appears in Appendix II. Correlations were computed only where the number of observations was greater than 10 for all three variables.

Table 3 displays descriptive statistics for the correlations of price with the eps, cfps and bvps across all 1500 companies. As the correlations are significantly skewed to the left, we deem the superior metric

to measure association to be the median, as opposed to the mean. Note that bvps, which is a balance sheet measure, has the highest median correlation with price (underlined and italicized). The two income statement measures, i.e. eps and cfps are lowest. Therefore, in the aggregate, bvps *might* be taken as the superior metric for portfolio decisions.

TABLE 3
DESCRIPTIVE STATISTICS ON THE COMPANY-PRICE CORRELATION COEFFICIENTS

	Mean	Median	Std. Dev	Skewness	Kurtosis	Sample size
eps	0.599	0.660	0.300	-1.196	1.807	1506
bvps	0.581	**0.706**	0.377	-1.359	1.445	1506
cfps	0.489	0.554	0.362	-0.841	0.188	1506

The correlations for price with eps, cfps and bvps were also observed by size and sector. Table 4 displays median correlations by Index. Notice again, that bvps has the highest median correlation with price for each index.

TABLE 4
MEDIAN CORRELATIONS OF PRICE WITH EPS, CFPS AND BVPS BY INDEX

Index	eps	cfps	bvps	Sample size
SP 500	0.685	0.664	**0.729**	500
SP 400	0.672	0.536	**0.732**	400
SP 600	0.614	0.480	**0.666**	600

Table 5 displays median correlation coefficients by sector, with the highest median correlation in each sector underlined and italicized.

TABLE 5
MEDIAN CORRELATIONS BY SECTOR

	eps	cfps	bvps	Sample Size
Consumer Discretionary	**0.710**	0.606	0.667	253
Consumer Staples	0.775	0.721	**0.812**	71
Energy	0.570	0.699	**0.733**	84
Financials	**0.746**	0.362	0.583	211
Health Care	0.646	0.738	**0.792**	165
Industrials	0.740	0.616	**0.804**	231
Information Technology	0.517	0.437	**0.528**	229
Materials	0.642	0.590	**0.742**	93
Real Estate	0.384	0.485	**0.635**	98
Telecommunications	0.121	0.269	**0.316**	15
Utilities	0.654	0.538	**0.834**	55

Except for two sectors, i.e. Consumer Discretionary and Financials, bvps has the highest correlation with price. Consumer Discretionary and Financials sectors have eps as the highest correlation with price. At this point, we have no explanation for these two sectors having higher eps correlations.

No similar analysis was conducted based upon industry, as industry sample sizes become very low in many instances, making inferences difficult.

As bvps dominates the correlations with price on a security basis, this suggests bvps is the best metric to assess valuation. Two important caveats should be noted:

1. Correlation measures the degree of ***linear*** association between 2 variables. It assumes both variables are normally distributed, the relationship is linear and that the data not heteroscedastistic. These assumptions might not hold for many of the constituents. In these cases, Pearson's correlation might not be the best correlation to use, and conclusions about which correlation metric, in this case bvps, could be questioned.
2. Conclusions regarding portfolio selection should await a formal back-test over several years and cycles before deploying the conclusions regarding bvps as a portfolio strategy.
3. There is a chance that multiple regression using two or more independent variables would generate higher ***multiple*** correlation coefficients, and might facilitate better asset selection and portfolio performance.

CONCLUSIONS

This research concluded that the best correlation metric to assess over- and undervaluation for an equity security depends on the sector that the security appears in, but as a general proposition, bvps is the superior metric to assess over- or undervaluation. This conclusion is robust based upon size and sector. The research can be improved by considering nonlinear factors, robust correlations, and comparing international market segments.

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