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EQUITY VALUATION USING PRICE MULTIPLES: EVIDENCE FROM INDIA

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ABSTRACT

In this paper, we evaluate alternative price multiples for equity valuation purposes in the Indian context. Data are taken from 145 large companies that satisfy our screening criteria. The sample companies cover 13 prominent sectors, and the study period covers the years 1990–2007. We generate price forecasts based on each multiple by regressing the historical prices on different value drivers. We use two forecast evaluation criteria, namely root mean squared error and Theil's inequality coefficient. We find that price–to-earnings provide the best price forecast compared to the other three price multiples, price-to-book value, price to cash flow and price to sales. We also develop price forecasts based on pairwise combinations of these price multiples. The value driver combination book value-sales appears to be most efficient in terms of error minimisation. However, historical price to earnings as a standalone multiple performs better in equity valuation vis à vis all combinations of value drivers. We recommend that historical price to earnings (P/E) is the best price multiple for developing price forecasts in the Indian environment. Our findings are pertinent for market participants and financial regulators. The present work contributes to emerging market literature on equity valuation.

Keywords: price earnings ratio, price to book value ratio, relative valuation, price multiples, discounted cash flows

INTRODUCTION

Every asset, whether financial or real, has a value. To successfully invest and manage these assets, one should know not only what the value is but also the sources of the value. All assets can be valued, but the complexities and the details of valuation will vary from case to case. The role of valuation is different in diverse situations. Like in portfolio management, the role of valuation is determined by the investment philosophy of the investor. Valuation plays a limited role in portfolio management for a passive investor, whereas it plays a very important role for an active investor. There are different techniques through which analysts value equities. Some analysts use discounted cash flow (DCF) models to value shares, while others use price multiples such as the price-to-earnings and price-to-book value ratios. Technical analysts believe that prices are driven as much by investor psychology as by any underlying financial variables. Then there are information traders, who attempt to trade in advance of new information or shortly after it is revealed to financial markets, i.e., buying on good news and selling on bad news. Efficient marketers believe that the market price at any point in time represents the best estimate of the true value of the firm and that any effort to exploit perceived market in-efficiencies will cost more than they will make in extranormal profits.

While we tend to focus more on DCF valuation while discussing valuation, the reality is that most valuations are relative in nature. The value of most assets, from the house one buys to the stocks one invests in, are based upon how similar assets are priced in the market place. Relative valuation estimates the value of an asset by looking at the pricing of "comparable" assets relative to a common variable such as earnings, cash flows, book value or sales. There are two components to relative valuation. The first is that to value assets on a relative basis, prices have to be standardised, usually by converting prices into multiples of corporate fundamentals. The second is to find similar firms, which is difficult to do, as no two firms are identical and firms in the same business can still differ in terms of risk, growth potential and cash flows.

It is the most popular technique of valuing an asset because, firstly, a valuation based upon a multiple for comparable firms can be quickly estimated with far fewer assumptions and in a speedy manner compared to DCF analysis. Secondly, relative valuation is simpler to understand and easier to present to clients and customers. Finally, in situations where market valuations are absent, either because the share capital is privately held or because the proposed publicly traded entity has not yet been created like in case of spinoffs, relative valuation is the only solution to find value in such cases. Valuations under this approach can be standardised relative to the earnings firms generate, to the book value or replacement value of the firms themselves, to the revenues that firms generate or to the firms' cash flows. Some of the important multiples in relative valuations are earnings multiples, which can be estimated using current earnings per share, yielding a current price to earnings (P/E), earnings over the last four quarters, resulting in a trailing P/E, or expected earnings per share in the next year, providing a forward P/E. Book value (P/BV) or replacement value multiple, which is the accounting estimate of book value, is determined by accounting rules and is heavily influenced by the original price paid for any assets and any accounting adjustments (such as depreciation, inventory valuation etc.) made since. For those who believe that the book value is not a good measure of the true value of assets, an alternative is to use the replacement cost of the assets; the ratio of the value of firm to its replacement cost is called Tobin's Q. Another important price multiple used in the industry is based on firm revenues; this is a ratio of the value of an asset to the revenue it generates. For equity investors, this ratio is the price-to-sales ratio (P/S), where the market value per share is divided by the revenues generated per share. Some equity researchers emphasise price-to-cash flow (P/CF) ratios instead of traditional P/E ratios, as the later are impacted by the accounting treatment for certain item, as has been shown forearnings per share (EPS) above, the firm's financial statements.

Analysts rely heavily on relative valuations for forecasting purposes because of their importance as mentioned above. In the investment community, be the equity research firms, venture capitalists, trading firms, investment banks or hedge funds, among others, relative valuation is the most acceptable technique for valuing stocks apart from DCF valuation. A lot of empirical work has been conducted for matured markets[1] relating to the robustness of value drivers in deriving equity prices. However, similar work for emerging markets[2] such as India is limited.

Therefore, there seems to be a major research gap on the subject for the Indian environment. Most of the work done by Indian researchers relates to P/E ratios, whereas no concrete research has been done on other value drivers such as book value, sales and cash flows. The present study attempts to fill the research gap on the subject and contribute to the body of literature relating to equity valuation. This study has the following objectives: (i) to understand which standalone value driver is best for forecasting prices, and (ii) to evaluate whether the combination of value drivers forecasts prices better than standalone value drivers. Its corollary would be that, if a combination of value drivers gives superior results to standalone value drivers, then different value drivers provide separate pieces of information for valuing stock and thus should be combined to get the fair price.

The study is organised into six sections, including the present one. Section 2 provides a brief review of literature. Section 3 describes the data and their sources. Equity valuation using historical price multiples is discussed in section 4. In section 5, we analyse equity valuation using a combination of historical price multiples and compare it with our findings for standalone multiples. A summary and concluding remarks are contained in the last section.

REVIEW OF LITERATURE

There is a lot of literature in textbooks (e.g., Copeland, Koller and Murrin (1994), Damodaran (1996), and Palepu, Healey, and Bernard (2000)) discussing price multiples. Interestingly, there are a few research papers published on this subject. While international papers concentrated on all multiples, Indian work has been confined to P/E ratios. Among all the value drivers, most of the research work has been done on historical earnings and cash flows. Boatsman and Baskin (1981) study the valuation accuracy of P/E multiples based on two sets of comparable firms from the same industry. They observe that valuation errors are minimised when comparable firms are chosen based on similar historical earnings growth relative to when they are chosen randomly. Alford (1992) examines the effect of choosing comparables based on industry, size (risk), and earnings growth on the meticulousness of valuation using P/E multiples. He finds that pricing errors decline when the industry definition used to select comparable firms is narrowed from a broad single-digit sector industry company (SIC) code to classifications based on two and three digits. He also observes that controlling for size and earnings growth over and above industrial controls does not reduce valuation errors. Kaplan and Ruback (1995) analyse the valuation properties of DCF approach for highly leveraged transactions. They find that although DCF valuations approximate transacted values reasonably well, simple EBITDA (earnings before interest, tax, depreciation and amortisation) multiples also result in similar valuation accuracy.

Penman (1996) interprets the P/E ratio and market-to-book ratio and describes what they represent. The study also describes the role of book rate of return on equity (the ratio of their denominators) in the determination of ratios and the relationship between them. The study proves that the description of the P/E ratio reconciles the standard growth interpretation of P/E with the transitory earnings (Molodovsky Effect[3], 1953) interpretation. Both are correct only in special cases. It also reveals that because a given level of P/E can be associated with alternative combinations of current & expected future return on equity, the current return on equity is not (unconditionally) a good indicator of P/E. Penman (1997) investigates approximate benchmark valuations that combine earnings and book value together. He estimates weights such that a benchmark price = *w1**book value + *w2** earnings is calculated, and he also examines the robustness of these weights over time. Penman (1997) tries to combine the two multiples into one price so that the information provided by both of them can be used. The study shows that weights vary in a nonlinear way over the amount of earnings relative to book value and systematically so over time. His study also demonstrates that estimated weights are robust over time and can be used to predict prices when they are applied out of sample. In addition the study also gives meaning to the weights and explains why they might vary over the differences between earnings and book value.

Tasker (1998) compares across-industry patterns in the selection of comparable firms by investment bankers and analysts in acquisition transactions. She finds the systematic use of industry-specific multiples, which is consistent with different multiples being more appropriate in different industries. Beatty, Riffe, and Thompson (1999) analyse different linear combinations of value drivers derived from earnings, book value, dividends, and total assets. They derive and document the benefits of using the harmonic mean and introduce the price-scaled regressions. They find that the best performance is achieved by using (i) weights derived from harmonic mean book and earnings multiples and (ii) coefficients from price-scaled regressions on earnings and book value. Baker and Ruback (1999) study econometric problems associated with different ways to compute industry multiples and compare the relative performance of multiples based on EBITDA, EBIT (or earnings before interest and taxes), and sales. They empirically show that absolute valuation errors are proportional to value. They also demonstrate that industry multiples, estimated using the harmonic mean, are close to minimum-variance estimates based on Monte Carlo simulations.

Instead of focusing only on historical accounting numbers, Kim and Ritter (in press), in their investigation of how initial public offering prices are set using multiples, add forecasted earnings to a conventional list of value drivers, which includes book value, earnings, cash flows, and sales. They find that forward P/E multiples, based on forecasted earnings, dominate all other multiples in valuation accuracy and that the EPS forecast for the next year dominates the current-year EPS forecast.

Liu, Nissim, and Thomas (2002a) examine the valuation performance of a comprehensive list of value drivers to determine which of them best explains the stock prices. The study investigates the performance of a comprehensive list of multiples and also examines a variety of related issues, such as the variation in performance across industries and over time by using alternative approaches to computing multiples. They find the following results with regard to the relative performance of different value drivers: (i) forward earnings perform the best, and performance improves if the forecast horizon lengthens (1-year- to 2-year- to 3-year-out EPS forecasts) and if earnings forecasted over different horizons are aggregated; (ii) the intrinsic value measures, based on short-cut residual income models perform considerably worse than forward earnings; (iii) among drivers derived from historical data, sales performs the worst, earnings performs better than book value; and IBES[3a] earnings (which excludes many one-time items) outperforms COMPUSTAT[3b] earnings; (iv) cash flow measures, defined in various forms, perform poorly; and (v) using enterprise value, rather than equity value, for sales and EBITDA further reduces performance. Liu, Nissim and Thomas (2002b) extend their previous work over different countries. In this paper, they examine the ability of industry multiples to approximate observed stock prices in ten countries. The value drivers examined are reported and forecasted numbers for earnings, dividends, cash flows and sales. They find that multiples based on earnings perform the best, those based on sales perform the worst and dividends and cash flow multiples exhibit intermediate performance. Second, using forecasts improves performance over multiples based on reported numbers, with the greatest (smallest) improvement being earnings (sales). Third, multiples based on earnings forecasts represent a reasonably accurate valuation technique, with the implied valuations for over half the firms in different countries being within 30% of observed valuations. Finally, they notice a sustained decline in the performance of all value drivers after 1997 due to increase within-industry heterogeneity in market valuations during this period. Liu, Nissim and Thomas (2007) try to find whether valuations based on cash flow multiples are better than earnings multiple. The methodology and sampling method are similar to that of their previous work. They observe that despite intuitive claims that operating cash flows are better than earnings as a summary measure of value, stock prices are better explained by reported earnings than by reported operating cash flows.

Huang, Tsai and Chen (2007) re–examine the P/E anomaly by decomposing P/E ratios into a fundamental component and a residual component, which enables them to capture factors that potentially provide better measures of investor overreaction. They find that both firm specific and macroeconomic factors determine P/E multiples. Analyst's long-term growth rate forecasts, the dividend pay-out ratio, and firm size are all positively associated with P/E ratio, while financial risk and aggregate bond yields are negatively associated with P/E ratios. They also discover strong evidence of performance reversals for the top P/E and bottom P/E portfolios in the years subsequent to the portfolio formation year, with the strongest reversal occurring in the first post-formation year. Da and Schaumburg (2008) document that, within-industry, relative valuations implicit in analyst target prices do provide investors with valuable information; although, the implied absolute valuations themselves are much less informative.

A small body of literature on price multiples is also available for emerging markets. Irina, Alexander and Ivan (2007) determine that in cross-border valuations, the use of market multiples (valuation ratios, e.g., P/E) should be restated, taking into account that the direct use of comparable companies (peers) from developed markets to value companies in emerging markets is inaccurate. They prove that using peers from developed markets would overstate the estimation of equity value in emerging markets, as companies from emerging markets are subject to various factors such as political and economic risk, a low level of corporate governance and high negative skewness, etc., and thus requires an adequate discount.

Gill (2003) demonstrates empirically that stock-market valuations are no longer driven solely by traditional investment principles. She finds that the low P/E ratio as an indicator does not hold good anymore and that there is nothing like a long-term investment strategy. She observes that there is an acceptable P/E range for different industries and that it is not only the past record of the P/E ratio but also the average P/E ratio for the industry that should be looked into. Lastly, she observes that the use of the P/E ratio along with the EPS growth rate could produce the more useful price earnings to growth (PEG) ratio, which is a sound indicator of a company's potential value. Dhankar and Kumar (2007) measure the performance of a set of portfolios, which are based on P/E of stocks. The study finds no consistency between the portfolios' expected return and their corresponding P/E ratios. It observes that the stock market failed to reflect an instantaneous response pertaining to earnings information. These findings question the efficient market hypothesis but hold the application of capital asset pricing model in the Indian stock market.

Sehgal and Pandey (2009) examine the behaviour of price multiples in India from 1990–2007. They observe that price-multiple distributions tend to be normal over the study period, thus making the mean and standard deviation of these multiples relevant parameters for equity analysis in the Indian context. They also find that there is a very weak relationship between price multiples and their fundamental determinants. The cross-sectional linear models do not seem to be good descriptors of price multiples. The study also proves that price multiples also seem to be sensitive to market conditions and, therefore, are generally higher in upturns with the exception of infrastructure related sectors.

DATA

We use data for 13 out of 20 major sectors based on sector classifications in the Bombay Stock Exchange 500 index (BSE500)[5]. Two sectors, namely, Diversified and Miscellaneous, are excluded from our work, as they are difficult to benchmark, while another five sectors (i.e., Media and Publishing, Tourism, Telecom, Consumer Durable and Transport Services) have been omitted as they have few listed companies with low trading volumes. For each sector, 5–12 large cap[6] companies are selected based on the criterion that i) the sample companies should have their financial year[7] closing in March each year, (ii) all the companies with prices of less than Rs 20 in a particular year have been omitted out of the sample for that year. This has been done to remove the effect of penny stocks in forecasting the prices, as they can have large distortions in forecasted prices, and (iii) the value drivers, especially referring to earnings and cash flows per share should be positive for a company in a given year. The study period is from 1990 to 2007 (18 years), and the number of sample companies varies for each sector on a year-to-year basis, owing to our selection criteria.

We cover 145 companies, which account for about 75% of market capitalisation as well as trading activity in India. The details of the data are provided in Figure 1. Therefore, the sample size is representative of market performance. The data, comprising yearly value drivers on a per-share basis, that is, EPS, BV, sales and cash flows, have been taken from Thomson - Reuters Datastream Software[8]. These price multiples are adjusted for capitalisation changes such as stock splits, stock dividends and rights issues. The definitions of these value drivers are given in Figure 2.

S. No.	Sector	No. of Companies
1	Agriculture	12
2	Capital Goods	12
3	Chemical and Petrochemical	12
4	Finance	12
5	Fast Moving Consumer Goods (FMCG)	12
6	Healthcare	12
7	Housing Related	12
8	Information Technology (IT)	12
9	Metal, Metal Products and mining	12
10	Oil and Gas	12
11	Power	6
12	Textile	7
13	Transport Equipment	12

Figure 1. Details of Sample Sectors

	Definitions
Price	Closing Price (End of the year closing price for a given financial year
EPS	(Net Profit – Preference Dividend – Dividend Tax)/Number of Shares
Book Value Per Share	Net worth / Number Of Shares And Net worth= Equity + Reserves & Surplus
Sales	Net Sales = Gross Sales – Excise Duty
Cash Flow Per Share	(Net Profit – Preference dividend-dividend tax + Depreciation)/Number of outstanding shares

Figure 2. Definitions of Price and Value Drivers

EQUITY VALUATION USING HISTORICAL PRICE MULTIPLES

In this section, we evaluate standalone price multiples to determine which of them is most efficient in forecasting prices. We forecast historical prices using four standalone value drives namely, EPS, BV, CF and sales. The forecasted price for each year is calculated by using a regression procedure, which has been explained below. We then subtract forecasted price from the actual price each year to get the series of pricing errors for the sample period. We next calculate root mean square error (Root MSE) and Theil's inequality coefficient for the series of pricing errors obtained for the sample companies. The price multiple for which pricing errors are minimal will be termed the most efficient one for valuing a share using historical data.

To compute the forecasted price, ordinary least square (OLS) estimation can be done including an intercept term as shown in the following equation:

$$p_{it} = \alpha_t + \beta_t \cdot \chi_{it} + \varepsilon_{it} \text{ ,} \quad (1)$$

where α_t is the intercept that captures the average effect of those factors that are not explained by value drivers, x_{it} is the value driver for firm i in year t, β_t is the multiple on the value driver and e_{it} is the pricing error. Many factors aside from the value driver under investigation affect price, and the average effect of such omitted factors is unlikely to be zero. Because the intercept in equation (i) captures the average effect of omitted factors, allowing for an intercept should improve the precision of out-of-sample predictions.

Through the above equation, we regress the base year price on the base year's value driver and use the OLS estimates to find out the expected price for the base year. To improve the efficiency of the estimation, we divide equation (1) by the expected price

$$\frac{p_{it}}{\hat{p}_{it}} = \frac{\alpha_t}{\hat{p}_{it}} + \beta t \frac{\chi_{it}}{\hat{p}_{it}} + \frac{\varepsilon_{it}}{\hat{p}_{it}} \quad (2)$$

We divide equation (1) by expected price and make it a GLS estimation equation to remove the effect of heteroscedasticity and to obtain a more efficient estimate of the value driver. Var (ε_i) is heteroscedastic with respect to the square of expected prices in the form of Var (ε_i) = $f\,(E\,(P_i)^2)$. Step 2 is performed only in those cases where there is significant heteroscedasticity as shown by White's heteroscedasticity (no cross-term) residual test[9].

Estimating equation (2) with no restriction minimises the square of pricing errors, but the expected value of these errors is non-zero. Empirically, it has been proved by Liu, Nissim, and Thomas (2002) that imposing the restriction that expected pricing errors (E (ε /p)) must be zero, generates lower pricing errors for most firms relative to an unrestricted estimate. However, it generates substantially higher errors in the tail of the distribution. By restricting oneself to unbiased pricing errors, one is in effect assigning lower weights to extreme pricing errors, relative to an unrestricted approach. By doing so, one is also maintaining consistency with the tradition in econometrics that strongly prefers unbiasedness over reduced dispersion. Therefore, we impose the restriction that pricing errors be unbiased. That is, we seek to estimate the parameters α_t and β_t that minimise the variance of $\left(\frac{\varepsilon_{it}}{\hat{p}_{it}}\right)$,

subject to the restriction that expected value of residual term is zero:

$$\min_{\alpha,\beta} \operatorname{var}\left(\frac{\varepsilon_{it}}{\hat{p}_{it}}\right) = \operatorname{var}\left[\frac{\hat{p}_{it} - \alpha_t - \beta_t \cdot \chi_{it}}{\hat{p}_{it}}\right] = \operatorname{var}\left(1 - \left[\alpha_t \frac{1}{\hat{p}_{it}} + \beta_t \frac{\chi_{it}}{\hat{p}_{it}}\right]\right), \tag{3a}$$

$$s.t. \qquad \mathrm{E}\left(\frac{\varepsilon_{it}}{\hat{p}_{it}}\right) = 0 \tag{3b}$$

It can be shown that the estimates for α_t and β_t that satisfy (3a) and (3b) are as follows:

$$\mathrm{B}t = \frac{\mathrm{E}\left(\frac{\chi_t}{\hat{p}_{it}}\right)\operatorname{var}\left(\frac{1}{\hat{p}_{it}}\right) - \operatorname{cov}\left(\frac{1}{\hat{p}_{it}}, \frac{\chi_t}{\hat{p}_{it}}\right) E\left(\frac{1}{\hat{p}_{it}}\right)}{\mathrm{E}\left(\frac{1}{\hat{p}_{it}}\right)^2 \operatorname{var}\left(\frac{\chi_t}{\hat{p}_{it}}\right) + \mathrm{E}\left(\frac{\chi_t}{\hat{p}_{it}}\right)^2 \operatorname{var}\left(\frac{1}{\hat{p}_{it}}\right) - 2\mathrm{E}\left(\frac{1}{\hat{p}_{it}}\right)\mathrm{E}\left(\frac{\chi_t}{\hat{p}_{it}}\right)\operatorname{cov}\left(\frac{1}{\hat{p}_{it}}, \frac{\chi_t}{\hat{p}_{it}}\right)} \tag{4}$$

$$\alpha_t = \frac{1 - \beta_t E\left(\frac{\chi_t}{\hat{p}_{it}}\right)}{E\left(\frac{1}{\hat{p}_{it}}\right)} \tag{5}$$

where the different *Et*[.], var(.), and cov(.) represent the means, variances, and covariances of those expressions for the population and are estimated using the corresponding sample moments for the comparable group. After setting the above restriction, we compute the forecasted price for the next year through GLS estimation. We next estimate pricing errors, defined by equation (6), and examine their distributions to determine performance:

$$\frac{\varepsilon_{it}}{\hat{p}_{it}} = \frac{p_{it} - \hat{\alpha}_t - \hat{\beta}_t \chi_{it}}{\hat{p}_{it}} \tag{6}$$

The pricing error is calculated as a difference between the actual price and the forecasted price. We repeat the same procedure for each sector and for all the years starting from 1991 to 2007. We compute the root MSE and Theil's inequality coefficient on the series of pricing errors over the study period, and the price multiple with the lowest pricing error is considered the most efficient one.

Root mean squared error depends on the scale of the dependent variable. It is used as a relative measure to compare forecasts for the same series across different models. According to this criterion, a smaller error in a model indicates the model's having better forecasting ability. It is calculated as follows:

$$\text{Root Mean Squared Error} = \sqrt{\frac{\sum_{t=t+1}^{T+h}\left(y_t - \hat{y}_t\right)^2}{h}} \tag{7}$$

where

y_t = Observed value

$\hat{y}_t$ = forecasted value

h = number of observations

Theil's Inequality Coefficient is scale invariant. It always lies between 0 and 1, where 0 indicates a perfect fit. It is estimated as follows:

$$\text{Theil's Inequality Coefficient} = \frac{\sqrt{\dfrac{\sum_{t=t+1}^{T+h}\left(y_t - \hat{y}_t\right)^2}{h}}}{\sqrt{\dfrac{\sum_{t=T+1}^{T+h} y_t^{\,2}}{h}} + \sqrt{\dfrac{\sum_{t=T+1}^{T+h} \hat{y}_t^{\,2}}{h}}} \qquad (8)$$

Through these two measures, we evaluate the sector pricing errors to determine the most efficient price multiple based on the error minimisation criterion. The price multiple whose pricing error, as per both measures, is least among the four multiples viz. P/E, P/BV, P/CF and P/S, for most of the sectors will be set as the most efficient one in forecasting prices.

Next, we try to determine the most efficient standalone price multiple for predicting prices at the market level. We add all the pricing errors for the sample sectors across time for each price multiple and compute the root MSE and Theil's inequality coefficient to determine the best price multiple in predicting prices at the market level.

We find that the pricing errors for forecasted prices based on P/E multiples are lowest compare to other multiples, using both the forecast evaluation measures. As shown in Table 1, P/E exhibits the minimum price error in four sectors and performs the second best for five other sectors according to the root mean squared error criterion. Similarly, it is shown in Table 2 that P/E performs best for six sectors and second best for six more sectors according to Theil's inequality coefficient criterion. In total, P/E is in the top two positions in 9(12) out of the total 13 sectors as per the root MSE criterion (Theil's inequality coefficient) criterion. P/E is followed by P/BV, which is in the top two positions in terms of minimum pricing errors for 10 sectors as per the root MSE criterion and four sectors as per Theil's inequality coefficient criterion. P/CF and P/S ratios have not performed as well. Our analysis suggests that equity valuation in India can be performed well by using P/E for all the sample sectors except agriculture sector, where P/CF and P/S ratios do a better job.

Table 1

Root Mean Squared Error based on Standalone Value Drivers

S. No	Sector	EPS	BV	CF	Sales
1	Agriculture	139.334	199.854	101.442	97.703
2	Capital Goods	300.320	304.326	305.653	338.149
3	Chemical	271.457	251.549	2088.204	148.846
4	Finance	188.924	398.400	187.379	211.098
5	FMCG	274.286	278.968	380.299	294.204
6	Healthcare	173.032	179.025	713.348	173.676
7	Housing Related	111.426	105.893	109.635	95.920
8	Information Technology	658.824	725.617	564.449	1931.870
9	Metals	128.286	125.131	129.901	139.147
10	Oil and Gas	215.496	223.904	238.196	269.465
11	Power	133.150	100.083	174.883	177.346
12	Textile	259.041	117.349	567.159	554.312
13	Transport Equipment	221.654	205.289	831.116	227.817
	Market	290.910	322.321	754.877	678.838

Table 2

Theil's inequality coefficient for Standalone Multiples

S. No.	Sector	EPS	BV	CF	Sales
1	Agriculture	0.424	0.521	0.364	0.370
2	Capital Goods	0.349	0.359	0.355	0.365
3	Chemical	0.474	0.509	0.886	0.309
4	Finance	0.279	0.503	0.278	0.318
5	FMCG	0.399	0.424	0.481	0.442
6	Healthcare	0.284	0.305	0.653	0.288
7	Housing Related	0.331	0.333	0.335	0.328
8	Information Technology	0.554	0.572	0.494	0.820
9	Metals	0.363	0.371	0.364	0.371
10	Oil and Gas	0.352	0.375	0.385	0.425
11	Power	0.253	0.224	0.350	0.342
12	Textile	0.537	0.290	0.668	0.753
13	Transport Equipment	0.366	0.403	0.674	0.401
	Market	0.418	0.456	0.656	0.648

We next add the pricing errors for all the sectors to determine the most efficient price multiple at the market level. We observe, like at the sector level, that the P/E ratio emerges as the most efficient multiple for equity valuation purposes at the market level as well. Both the forecast evaluation measures have the minimum pricing error for P/E. P/BV is the next most efficient price multiple, whereas P/CF is the worst performer and P/S is in the third place according to both the tests.

Therefore, we can conclude that, in the case of historical standalone multiples, both at the sectoral level as well as at the market level, historical P/E is the most efficient price multiple for equity valuation, followed by P/BV. Our results are consistent with those for matured markets as shown by Liu, Nissim and Thomas (2002a and 2002b).

EQUITY VALUATION USING COMBINED HISTORICAL MULTIPLES

In this section, we evaluate combined historical price multiples to verify the following:

i. Which is the best combination for forecasting prices and
ii. How do the combined multiples perform *vis-à-vis* standalone multiples in equity valuation.

We evaluate six combinations of value drivers, namely, EPS- BV, EPS-CF, EPS-Sales, CF-BV, CF-Sales and BV-Sales, to analyse combined historical multiples. We follow the following estimation process: In step 1, we make stock price a function of a combination of value drivers, as shown in equation (9) below:

$$p_{it} = \alpha_t + \beta_{1t} \cdot \chi_{1t} + \beta_{2t} \cdot \chi_{2t} + \varepsilon_{it} \qquad (9)$$

where α_t is the intercept which captures the average effect of those factors that are not explained by value driver, x_{it} is the value driver for firm i in year *t*, β_{1t} and β_{2t} are price multiples for the respective value drivers and e_{it} is the pricing error. Through the above equation, we regress the base-year price with the base year's value drivers to determine the expected price for base year.

To improve the estimation efficiency, we divide equation (9) by the expected price. This step is performed only in those cases where there is significant heteroscedasticity as shown by White's heteroscedasticity (no cross-term) residual test.

$$\frac{p_{it}}{\hat{p}_{it}} = \frac{\alpha_t}{\hat{p}_{it}} + \beta_{1t}\frac{\chi_{1t}}{\hat{p}_{it}} + \beta_{2t}\frac{\chi_{2t}}{\hat{p}_{it}} + \frac{\varepsilon_{it}}{\hat{p}_{it}} \tag{10}$$

We estimate equation (10) by following the restriction for the error term specified in the previous section, $\left(\frac{\varepsilon_{it}}{\hat{p}_{it}}\right)$=0, so that our regression estimates are unbiased. We obtain forecasted prices from equation (10) and then use them to calculate our pricing errors using equation (8). We adopt root MSE and Theil's inequality coefficient as our criteria for checking the quality of price forecasts, as was done in the previous section. Finally, we evaluate pricing errors at the market level.

While analysing pricing error distributions for combined multiples, we find (see Tables 3 and 4) that the errors are minimal for the combination of BV-Sales value drivers according to both the criteria. Per both root MSE and Theil's test, the BV-Sales combination has the minimal pricing error for five sectors and performs second best for three additional sectors. EPS-CF and CF-Sales are other good combinations based on pricing error minimisation criteria. It can be seen from the tables that EPS-BV performs worst and remains in the last position for seven and nine sectors according to root MSE and Theil's inequality coefficient, respectively.

Table 3
Root Mean Squared Error Based on Pairwise Combination of Value drivers

S. No	Sector	EPS-BV	EPS-CF	EPS-Sales	CEPS-BV	CEPS-Sales	BV-Sales
1	Agriculture	1043.623	119.450	104.820	257.000	98.394	97.133
2	Capital Goods	559.962	398.749	312.153	367.846	298.173	299.650
3	Chemical	5611.331	226.247	161.232	1213.892	143.290	284.908
4	Finance	2690.492	187.479	193.405	184.535	192.083	211.721
5	FMCG	28254.612	444.658	1038.018	787.642	4223.191	295.151
6	Healthcare	1072.254	6737.130	1049.232	254.811	901.102	177.939
7	Housing Related	3424.984	300.619	139.659	105.043	108.175	91.288
8	Information Technology	2193.447	513.280	542.193	504.281	546.221	710.276
9	Metals	132.237	126.978	147.975	130.966	144.861	137.300
10	Oil and Gas	468.466	774.822	287.413	257.714	224.660	221.700
11	Power	121.201	191.514	128.670	760.812	224.486	711.157
12	Textile	357.416	257.601	277.498	132.608	549.983	146.896
13	Transport Equipment	486.767	216.991	381.388	15582.574	3354.743	226.629
	Market	9166.620	2330.611	560.851	3630.754	1582.117	332.357

Table 4
Theil's Inequality Coefficient Based on Pairwise Combination of Value Drivers

S. No.	Sector	EPS-BV	EPS-CF	EPS-Sales	CEPS-BV	CEPS-Sales	BV-Sales
1	Agriculture	0.829	0.382	0.375	0.626	0.367	0.366
2	Capital Goods	0.518	0.415	0.327	0.380	0.311	0.314
3	Chemical	0.955	0.428	0.326	0.832	0.317	0.509
4	Finance	0.881	0.280	0.285	0.282	0.283	0.317
5	FMCG	0.985	0.521	0.782	0.639	0.918	0.408
6	Healthcare	0.761	0.950	0.731	0.370	0.701	0.296
7	Housing Related	0.965	0.652	0.428	0.316	0.314	0.304
8	Information Technology	0.811	0.491	0.496	0.501	0.482	0.571
9	Metals	0.367	0.351	0.365	0.365	0.353	0.364
10	Oil & Gas	0.567	0.657	0.393	0.373	0.340	0.338
11	Power	0.228	0.318	0.211	0.638	0.389	0.763
12	Textile	0.669	0.612	0.501	0.318	0.683	0.326
13	Transport Equipment	0.590	0.367	0.455	0.980	0.920	0.396
	Market	0.960	0.860	0.576	0.909	0.803	0.440

At the market level, we also find that BV-Sales is the best combination for predicting price according to both the tests. Contrary to the sector-level analysis, EPS-Sales emerges as the best combination according to both the criteria at the market level. EPS-BV has performed worst according to both the criteria, which is in conformity with the sector-level analysis. The third, fourth and fifth positions are held up by CF-Sales, EPS-CF and CF-BV, respectively.

Comparison of Standalone and Combined Historical Multiples

When we compare standalone multiples with combined multiples, it can be seen that EPS (the best standalone value driver) provides lower pricing errors compared to BV-Sales (the best combination of value drivers) for 9 and 7 out of 13 sample sectors based on root MSE and Theil's criteria respectively. At aggregate market level EPS again outperforms the BV-Sales combination. In conclusion, the P/E ratio (with EPS as a relevant value driver) seems to be the most appropriate approach to equity valuation in India as compared to other price multiples at the sectoral level as well as at the aggregate market level. Our results imply that combining value drivers for equity valuation does not result in any additional relevant information for building price forecast. Our findings are in contrast with those for the US market (see Penman 1996), where the combined value drivers outperform standalone multiples for equity valuation.

SUMMARY AND CONCLUDING REMARKS

Relative valuation is an important method for equity analysis and evaluation, which is highly popular among market practitioners. P/E, price to book value, price to cash flow and price to sales are the four key multiples that form part of the relative valuation toolbox. In this study, we test the relative efficacy of these price multiples and their combinations for equity valuation purposes. We use data for 145 Indian companies belonging to 13 prominent sectors from 1990–2007.

We generate price forecasts based on each multiple by regressing the historical prices on relevant value drivers. We check the price forecast error for each price multiple (and hence its resultant value driver) using (i) the root mean squared error and (ii) Theil's inequality coefficient criteria. It was observed that the price-to-earnings ratio provides the best price forecast (and hence the minimum pricing errors) for most of the sample sectors. Further, price to book value seems to be the second-best financial ratio for equity valuation. P/E also performs best *vis à vis* other multiples on an aggregate market basis.

Next, we combine the four price multiples pairwise and form six value-driver combinations to develop price forecasts. The combined value-driver process will be useful if each value driver tends to provide a different piece of information about future price forecasts. We observe that the BV-Sales combination provides the best forecast results both at the sectoral level and at the market level. Finally, we find that P/E as the best standalone multiple outperforms BV-Sales, which is the best value driver combination in terms of pricing error minimisation.

We recommend that historical P/E (and hence EPS as a value driver) is the best approach for equity valuation in the Indian context. Further, any combination of price multiples does not seem to provide a better price forecast compared to historical P/E. Our findings are extremely relevant for market players, such as equity analysts, portfolio managers and global fund managers, who are continuously involved in equity valuation including the use of relative valuation criteria. They are also pertinent for financial regulators, who use the price multiples to gauge the level of market as well as investor sentiment and realign their policy interventions. Our results contribute to the emerging market literature in the field of equity valuation and have implications for portfolio analysis and management in the Indian environment. In terms of global investing, it will be interesting to compare our results with those of other world markets, especially emerging economies.

NOTES

1. Matured Markets: For details, refer to Boatsman and Baskin (1981), Alford (1992), Kaplan and Ruback (1995), Penman (1996), Penman (1997), Tasker (1998), Baker and Ruback (1999), Beatty, Riffe and Thompson (1999), Kim and Ritter (in press), Liu, Nissim and Thomas (2002a and 2002b), Liu, Nissim and Thomas (2007), Huang, Tsai and Cheng (2007) and Da and Schaumburg (2008).
2. Emerging Markets: For details, refer to Irina, Alexander and Evan (2007), Gill (2003), Dhankar and Kumar (2007), and Sehgal and Pandey (2009).
3. Molodovsky Effect: Assuming that a high P/E stock is a growth stock may be problematic. The problem with this assumption is that the "E" component may be depressed, as the earnings are at a low point in economic cycle. So what we have in this case is a cyclical stock, which may not be a growth stock at all. This misleading high P/E is known as the "Molodovsky Effect", named after Nicholas Molodovsky, who discussed this issue in his article "A Theory of Price Earnings Ratios" in the Analyst Journal (1953).
4. IBES and COMPUSTAT: They are the financial software in U.S. that provide earnings estimates for sample firms based on different sets of assumptions.
5. BSE Sensex: BSE Sensex, or the Bombay Stock Exchange Sensitive Index, is a value-weighted index composed of 30 stocks started in April, 1984. It consists of the 30 largest and most actively traded stocks, representative of various sectors, on the Bombay Stock Exchange. These companies account for around one fifth of the market capitalisation of the BSE.
6. BSE 500: The Bombay Stock Exchange Limited constructed a new index, christened BSE-500, consisting of 500 scrips w.e.f. August 9, 1999. The BSE-500 index represents nearly 93% of the total market capitalisation on BSE. BSE-500 covers all 20 major industries of the economy. In line with other BSE indices, effective August 16, 2005, the calculation methodology was shifted to the free-float methodology.
7. Large Cap: In the Indian context, "large cap" is a term used by the investment community to refer to companies with a market capitalisation value of more than $5 billion. Large cap is an abbreviation of the term "large market capitalisation". Market capitalisation is calculated by multiplying the number of a company's shares outstanding by its stock price per share.
8. Financial Year: Is a period used for calculating annual ("yearly") financial statements in businesses and other organisations. In many jurisdictions, regulatory laws regarding accounting and taxation require these reports once every 12 months but do not require that the period reported on constitutes a calendar year (i.e., January through December). Fiscal years vary between businesses and countries. In India, the government's financial year runs from April 1 to March 31.
9. Thomson - Reuters Datastream Software: It is a financial and macroeconomic database, covering major instruments, company fundamentals, equities, fixed-income securities and economic indicators for 177 countries and 60 markets worldwide.
10. White Heteroscedasticity Test: These tests are the extension of White's (1980) test to systems of equations as discussed by Kelejian (1982) and Doornik (1995). The test regression is run by regressing each cross product of the residuals on the cross products of the regressors and testing the joint significance of the regression. The No Cross Terms option uses only the levels and squares of the original regressors, while

the With Cross Terms option includes all non- redundant cross-products of the original regressors in the test equation. The test regression always includes a constant term as a regressor. If the chi-square value at the chosen level of significance or the *p*-value of the compute chi-square value is reasonably low (say 1% or 5%), we can reject the null hypothesis of heteroscedasticity.

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