Valuation Models and Their Efficacy Predicting Stock Prices

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Abstract

Using several valuation models, this study estimates stocks prices of all companies included in the Dow Jones Industrial, Transportation, and Utility Indexes over several time periods. The estimated values are then compared with actual stock prices to test the accuracy of the models used in the valuation process. The test results show that the estimated stock prices using discounted cash flow, market-value-added, and multiplier methods differ greatly from their actual prices, indicating that valuation have limited application value. The weak performance of valuation models may lead investors and students to become cynical about the valuation theory and discount or discard the fundamental idea behind the intrinsic value calculation.

Key words: Valuation Models, Stock Price, Market Value added, Cash Flow

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Introduction

It is believed that financial securities have an intrinsic value that can be determined by using selected models and financial variables. Investment bankers, corporate financial officers, and governments extensively employ valuation models to make investment decisions and evaluate the potential returns from capital projects and investments.

Contrary to the general acceptance of valuation models to predict share values, some studies have concluded that the stock prices resembles a random walk and that past performances will not be repeated. They assert that there are no under or over-valued stock prices to be found using historical financial data and valuation models. To evaluate such differing views, this study examines whether discounted cash flow models, multiplier methods, and market-value-added approach presented in finance texts are useful tools for predicting stock prices.

One of the early attempts to estimate the intrinsic value of stocks was made by Williams (1938) who introduced the dividend-discount model for predicting stock prices. In extending the Williams model, Gordon (1962) introduced the constant-dividend growth model. Gordon's model has been extensively used in the investment management profession and its application has been extended for cases when dividends grow at non-constant rates. Using fundamental security analysis techniques, known as the short-term-earnings-multiple approaches, Graham and Dodd (1934, 1940) sought to discover investment opportunities in the stock market. In a later study, Graham, Dodd, and Cottle (1962) claimed that the most important factor determining a stock's price is the estimated average earnings of the firm in the future. Taking a different approach, Fama (1965) showed that stock price performance resembled a random walk, and in a later study (1970) in which he formulated the efficient market theory, he challenged the validity of intrinsic valuation models and the use of historical and public information data in estimating stock prices. Instead, Fama argued that the price of a security fully reflects all available information at a point in time. Lee, Myers, and

Swaminathan (1999) have compared the performance of alternative estimates of intrinsic value for 30 stocks in the Dow Jones Industrial Index for the period of 1963-1996, and found that traditional valuation methods using multiplier techniques have little predictive power. Using a different approach, Liu, Nissim, and Thomas (2002) examined the valuation performance of a list of value drivers and found that multipliers derived from forward earnings explained stock prices quite well. They showed that pricing errors were within 15 percent of stock prices for about half of the stock included in their sample. In examining whether there has been a stable relation between stock prices and dividends for firms in the S&P 100, Nasseh and Strauss (2004) have used the present-value model and found that there exists a close link between stock prices and dividends. However, since the mid-1990s, they concluded that the present-value model has produced a disproportion of underestimated stock prices. Among several authors, Brigham and Daves (2002), Moyer, McGuigan, and Kretlow (2003), Mayo (2003), Brigham and Houston (2004), and Hirt and Block (2006) have described discounted cash-flow (DCF) models plus a variety of multiplier techniques to estimate stock prices.

Using discounted-valuation models, market-value-added approach, and several multiplier methods, the estimated and actual stock prices of all firms included in the Dow Jones Industrials, Transportation, and Utility Indexes are compared over several sample periods. First, the percentages of stock prices that were over and/or under-valued using valuation techniques were computed. Then, such estimates were evaluated by calculating the percent of the estimated prices that fall within a certain price ranges as acceptable. Using the $5 price range as a benchmark, the performance of the models were considered acceptable when they produced about an equal proportion of over and under-valued estimated prices, and significant numbers of the estimates fell in a price range that was close to the actual prices (i.e., in ±$5). The test results show that estimated stock prices using discounted cash-flow models and the multiplier approach differ greatly from their actual prices, indicating that valuation models taught at business schools have limited application and should be carefully employed in making investment decisions. The weak performance of valuation models may lead investors and students to become skeptical about valuation theory, and discount or discard the fundamental idea behind the intrinsic value calculation.

The valuation models and empirical results of my study are described in the following pages.

VALUATION MODELS

A. Dividend Valuation Models: Firms included in the Dow Jones Industrial, Transportation, and Utility Indexes are mostly in their maturity stages of their life-cycles and are the best candidates for the application of dividend valuation models. At maturity stage, a company's sales normally grow at a rate equal to that of the economy and its earnings and dividends generally are expected to grow in a constant rate. When divided payments make up a large portion of the expected company's earnings and its growth rate, g, is constant, the stock prices are estimated by using the following constant growth model:

$$\hat{P}_0 = \frac{D_1}{(k-g)}$$

where,

$\hat{P}_0$ = Estimated present value of the stock price
D_1 = Anticipated dividends next period
k = Required rate of return or discount rate
g = Dividend (earnings) growth rate

In reality, the dividends of a company never grow at a constant rate indefinitely. They usually increase or decrease over time, thus making the constant dividend model highly unrealistic to employ in making investment decisions. In cases where future dividend payments are not expected to grow at all, the stock price is estimated using the following equation:

$$\hat{P}_0 = \frac{D_0}{k}$$

B. Market-Value-Added

The market-value-added (MVA) measures present value of all expected future cash flows added to the firm. For each firm, the MVA is calculated as

MVA = (Stock Price) x (Common Shares Outstanding) – (Total Common Equity ($))

The market-value-added per share (MVA/P) is found by dividing the MVA by the total number of shares outstanding.

C. Multiplier Methods: The following multiplier techniques are known as short-term valuation models and are usually presented in financial texts to estimate the intrinsic value of stock prices.

1. Price-to-Dividend: In this method, the ratio of the average price-to-average dividends per share over some period is first calculated. This ratio is then multiplied by the estimated dividend per share ($D\hat{P}S$) to derive the estimated intrinsic value $\hat{P}_0$.

$$\hat{P}_0 = \frac{Average\,\mathrm{Pr}\,ice}{AverageDividendPerShare} \times D\hat{P}S$$

2. Price-to-Earnings: When a firm pays no cash dividends stock prices are estimated by predicting earnings per share $(E\hat{P}S)$ for the next period and then multiplying it with the average price-to-earnings ratio.

$$\hat{P}_0 = \frac{Average\,\mathrm{Pr}\,ice}{AverageEarningsPerShare} \times E\hat{P}S$$

3. Price-to-Earnings from Operation: Predicting stock prices using this method is done by estimating earnings per share from operation $(E\hat{P}O)$ for the next period and then multiplying it with the average price-to-earnings ratio.

$$\hat{P}_0 = \frac{Average\,\mathrm{Pr}\,ice}{AverageEarningsPerShare\ fromOperation} \times E\hat{P}O$$

4. Price-to-Book-Value: Fama and Fernch (1992) report that the ratio of book value to market value is more important than either the size or P/E ratio in explaining superior stock performance. The higher the ratio of book-value to market-value the higher the potential return on the stock. Stocks that have a book value close to market value are more likely to be undervalued than stocks which have book values that are substantially below market values. Under the price-to-book value method, the intrinsic value of stock is found by multiplying the ratio of the average price to average book value per share by the estimated book value per share $(BV\hat{P}S)$ as follow:

$$\hat{P}_0 = \frac{Average\,\mathrm{Pr}\,ice}{AverageBookValuePerShare} \times BV\hat{P}S$$

5. Price-to-Cash-Flow: Using this approach, the ratio of the average price-to-average cash flow per share is first calculated and then this ratio is multiplied by the estimated cash flow per share $(CF\hat{P}S)$ to obtain the intrinsic value per share.

$$\hat{P}_0 = \frac{Average\,\mathrm{Pr}\,ice}{AverageCashFlowPerShare} \times CF\hat{P}S$$

6. Price-to-Net-Income: Under this model, the ratio of average price-to-average net income per share is multiplied by the estimated net income per share $(NI\hat{P}S)$.

$$\hat{P}_0 = \frac{Average\,\mathrm{Pr}\,ice}{AverageNetIncomePerShare} \times NI\hat{P}S$$

7. Price-to-Sales: In this method, the ratio of average price-to-average sales per share over some previous years is multiplied by the estimated sales per share $(S\hat{P}S)$ for the next period to obtain the intrinsic value of the company's stock.

$$\hat{P}_0 = \frac{Average\,\mathrm{Pr}\,ice}{AverageSalesPerShare} \times S\hat{P}S$$

8. Price-to-Total-Asset: In this approach, the ratio of the average price-to-average total assets per share is multiplied by the estimated total assets per share $(A\hat{P}S)$.

$$\hat{P}_0 = \frac{Average\,\mathrm{Pr}\,ice}{AverageAssetsPerShare} \times A\hat{P}S$$

THE DATA

The data are obtained from the COMPUSTAT data base and several Web sites. The sample includes quarterly data for all firms in the Dow Jones Industrial, Transportation, and Utility Averages for the period 1980.1-2005.1. The required rate of return, K_j, for each stock is estimated using the Capital Asset Pricing Model (CAPM):

$$K_j = K_{rf} + \beta_j (K_m - K_{rf})$$

where, K_{rf} is the risk-free rate, measured by the 3-month T-bill rates; β_j, the measure of market risk, is calculated by dividing the covariance between return in the S&P500 stock price index, (K_m), and return in stock prices (K_j) over the variance of the market returns (σ_m^2) as:

$$\beta_j = \frac{COV(K_m, K_j)}{\sigma_m^2}$$

The dividend growth rate, g, is determined by multiplying the return on common equity (ROE) and retention rate (RR) for each firm as:

$$g = (ROE)(RR)$$

Book value per share is the total common equity divided by the number of common shares outstanding, whereas cash flow per share is calculated as the net income plus depreciation and amortization, divided by the number of shares outstanding. Operating earning per share, net income per share, sales per share, and assets per share are each calculated by dividing operating income after depreciation, net sales, and total assets by the total number of common shares outstanding, respectively. The market-value-added per share (MVA/P) is calculated by dividing the total market-value-added of each firm by the total number of common shares outstanding.

Table 1 presents the percentage of the Dow Jones Industrial (DJI), Dow Jones Transportation (DJT), and Dow Jones Utility (DJU) Indexes stock prices that are over and/or under-valued using zero and constant growth rate dividend models and market-value added method. Table 1 also includes the percentage of the estimated stock prices that fall within a five dollar price range from their actual values. To test the permanence of models over time, the entire data set were divided into five sample periods. The first sample included data for the period 1980.1 through 1984.4 to estimate the stock price for 1985.1. The second sample, covering data from 1985.1-1989.4, was utilized to predict share value for 1990.1. The data in samples 3, 4, and 5 were applied to predict stock prices for the 1995.1, 2001.1, and 2005.1 quarters, respectively. These estimated prices then were compared with their actual prices to determine the percent of companies for which their share values were either over or under-estimated. Also Table 1 includes the proportion of the DJI, DJT, and DJU companies for which predicted prices fell within the five dollar price range from their actual price.

Insert Table 1

As shown in Table 1, the present-value models produced a disproportion percent of under and over-estimated stock prices. The outcome of models considered desirable as those which produced equal proportions of over and under-valued estimates and greater numbers of the predicted share values close to their actual prices. As Table 1 shows, zero dividend growth models overestimated 30, 83, 7, 3, and 10 percent of DJI stock prices for periods 1985.1, 1990.1, 1995.1, 2001.1, and 2005.1, respectively. The same model also disproportionately over and under-estimated DJT and DJU stock prices and only a few companies intrinsic values did fall in $5 price range. The constant growth model also produced a disproportionate number of under and over-estimated stock prices. This model undervalued 84, 73, 97, 100, and 93 percent of DJI stock prices for the periods 1985.1, 1990.1, 1995.1, 2001.1, and 2005 and none of the estimates fell in the $5 price range.

The results of market-value-added (MVA) were slightly better than the DCF models in estimating DJI stock prices, but it performed poorly in predicting the share values for DJT and DJU firms. The overall poor performance of dividend -valuation models and market-value-added methods indicate that these models have limited value and should be avoided when making investment decisions. The weak credibility of these models may cause students and investors to become cynical about equity market theory, and to discount or discard the fundamental idea of valuation models.

Tables 2, 3, and 4 provide the percentage of over and under-valued stock prices and the intrinsic values that fell within the $5 price range from actual prices when using the various multiplier techniques.

Insert Tables 2, 3, and 4

As it is apparent from Tables 2, 3, and 4 the multiplier techniques performed relatively better than the discounted cash flow models presented in Table 1. For example, the proportion of over and under-valued share is less dispersed and a higher number of the estimated prices are within the $5 price range. Among all multiplier methods presented in the tables, the price-to-book-value method performed better than other methods listed. Using data from sample (2) to predict the DJI stock prices for 1990.1, the P/BVPS method produced a 43 and 57 percent over and under-valued share values, in which 40 percent of the predicted prices fell within the $5 price range. As shown in the Table 2 the predicted results have fluctuated and deteriorated over time. For example, all models appearing in Table 2 have overestimated DJI stock prices for 2005.1. The outcome of the multiplier models appearing in Tables 4 and 5 do not show any major improvements for DJT and DJU stock prices. However, there were larger number of intrinsic values that fell within the $5 price range when compared with the actual prices in 1990.1 than in 2005.1. This implies that the higher volatility of stock prices in recent years has caused valuation models to create unreliable estimates. Inconsistency and variation in the estimated intrinsic values imply that consistent identification of an over/under-valued Dow Jones firm using publicly available financial information and valuation models is minimal. This indicates that stock price movements are hard to predict and more likely resemble a random walk.

CONCLUSION: This study, using selected valuation models presented in finance texts, estimated the intrinsic values of all stocks included in the Dow Jones Industrial, Transportation, and Utility Indexes over five sample periods. The estimated values for each sample were then compared with actual prices to identify the percentage of firms whose prices were either under or over-valued and to test the accuracy and stability of the estimates over-time. The results show that the DCF and market-value-added models greatly over and under-valued the stock prices over time. Not surprisingly, the estimated intrinsic values employing the multiplier techniques also differed greatly from actual prices. The findings of this study confirm that the likelihood of a consistent identification of an over/under-valued firm using publicly available financial information and valuation models taught at business schools is not supported by the empirical work. In fact, the results are more in line with the efficiency of the securities markets and the finding of Fama (1965) that stock market performance resembles a random walk and that using past and market information will not generate superior results.

Although none of the valuation models employed in this study have consistently performed well in estimating the stock prices over time, the market-value-added approach generated relatively better estimates than the zero dividend and constant dividend growth models estimating DJI stock prices. Among all financial variables that were considered in this study, dividend and book-value had the highest effect predicting share values of DJI firms whereas, earnings had on DJT, and sales and total assets on DJU companies prices, respectively. Given the differing results of the valuation models, it is obvious that judging the worth a firm's stock prices depend on the valuation methods employed.

Despite their weak performance, valuation models are still being taught in business schools and covered in finance texts. Regardless of what position an instructor takes in teaching valuation models in class, the danger is that the weak credibility of these models may cause students to become skeptical about all equity market theory and its use. As a result, they may heavily discount or discard the fundamental idea of valuation techniques and lose their trust in the usefulness of securities markets as an efficient mechanism for the allocation of financial resources and investments.

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Table 1

Performance of DCF and Market-Value-Added Models Estimating Intrinsic Values of the Dow Jones Industrial, Transportation, and Utility Averages Stock Prices
Over Different Sample Periods

	Sample Periods																			
	(1)				(2)				(3)				(4)				(5)			
	1980.1-1984.4				1985.1-1989.4				1990.1-1994.4				1995.1-1999.4				2001.1-2004.4			
Est. For	**1985.1**				**1990.1**				**1995.1**				**2001.1**				**2005.1**			
Dow Jones Industrial Average (DJI)																				
	OV	**UN**	**NA**	**±$5**	**OV**	**UN**	**NA**	**±$5**	**OV**	**UN**	**NA**	**±$5**	**OV**	**UN**	**NA**	**±$5**	**OV**	**UN**	**NA**	**±$5**
DCF (Zero Growth Model)	30	57	13	10	83	7	-	0	7	93	-	0	3	97	-	0	10	90	-	0
DCF (Constant Growth Model)	3	84	13	3	0	73	7	0	3	97	-	0	0	100	-	0	7	93	-	0
MVA/P	10	83	7	3	13	87	-	3	17	83	-	7	33	67	-	3	23	77	-	10
Dow Jones Transportation Average (DJT)																				
	OV	**UN**	**NA**	**±$5**	**OV**	**UN**	**NA**	**±$5**	**OV**	**UN**	**NA**	**±$5**	**OV**	**UN**	**NA**	**±$5**	**OV**	**UN**	**NA**	**±$5**
DCF (Zero Growth Model)	15	55	30	5	5	75	20	0	0	80	20	0	0	85	15	0	0	95	5	0
DCF (Constant Growth Model)	5	65	30	5	0	80	20	0	0	80	29	5	5	89	15	0	0	95	5	0
MVA/P	0	80	20	10	5	75	20	10	10	75	15	0	15	80	5	25	10	90	-	5
Dow Jones Utilities Average (DJU)																				
	OV	**UN**	**NA**	**±$5**	**OV**	**UN**	**NA**	**±$5**	**OV**	**UN**	**NA**	**±$5**	**OV**	**UN**	**NA**	**±$5**	**OV**	**UN**	**NA**	**±$5**
DCF (Zero Growth Model)	73	20	7	20	7	86	7	0	27	67	6	0	87	13	-	0	93	7	-	7
DCF (Constant Growth Model)	40	53	7	33	7	86	7	0	27	67	6	7	87	13	-	0	0	100	-	0
MVA/P	0	93	7	0	93	7	-	0	7	93	-	0	7	93	-	7	93	7	-	7

Note: OV and UN denote over and under estimated stock prices, NA indicates data were not available or were incomplete to estimate company's stock prices. The numbers in the table are rounded percentages rather than expressed as fractions. MVA/P denotes market-value added per share.

Table 2

Performance of Multiplier Techniques in Estimating Share Values of Dow Jones Industrial Averages Stock Prices Over Different Sample Periods.

	Sample Periods																			
	(1) 1980.1-1984.4				(2) 1985.1-1989.4				(3) 1990.1-1994.4				(4) 1995.1-1999.4				(5) 2001.1-2004.4			
Est. For	**1985.1**				**1990.1**				**1995.1**				**2001.1**				**2005.1**			
	OV	**UN**	**NA**	**±$5**	**OV**	**UN**	**NA**	**±$5**	**OV**	**UN**	**NA**	**±$5**	**OV**	**UN**	**NA**	**±$5**	**OV**	**UN**	**NA**	**±$5**
P/DPS	15	50	35	30	35	25	40	20	25	40	35	20	55	20	25	20	35	25	20	15
P/EPS	15	65	20	15	35	40	25	20	35	50	15	5	60	30	10	0	55	45	-	25
P/EPO	-	-	100	0	20	55	25	20	15	70	15	15	35	60	5	10	45	55	-	5
P/BVPS	35	40	25	15	50	30	20	25	35	50	15	25	60	35	5	25	30	70	-	15
P/CFPS	25	40	35	15	45	30	25	10	25	55	20	30	65	30	5	20	40	55	5	10
P/NIPS	20	60	20	15	40	40	20	15	15	65	20	5	55	40	5	15	35	40	25	5
P/SPS	35	45	20	15	60	20	20	10	25	60	15	10	55	40	5	15	25	75	-	15
P/TAPS	50	30	20	5	65	15	20	10	45	35	25	10	75	20	5	30	25	75	-	5

Note: OV and UN denote over and under estimated stock prices, NA indicates data were not available or were incomplete to estimate company's stock prices. The numbers in the table are rounded percentages rather than expressed as fractions. P/DPS is price-to-dividend, P/EPS is price-to-earning per, P/EPO is price-to- earnings from operations, P/BVPS is price-to-book value, P/CFPS is price-to-cash flow, P/NIPS is price-to-net income, P/SPS is price-to-sales, and P/TAPS is price-to-assets per share.

Table 3

Performance of Multiplier Techniques in Estimating Share Values of the Dow Jones Transportation Averages Stock Prices Over Different Sample Periods

	Sample Periods																			
	(1)				(2)				(3)				(4)				(5)			
	1980.1-1984.4				1985.1-1989.4				1990.1-1994.4				1995.1-1999.4				2001.1-2004.4			
Est. For	**1985.1**				**1990.1**				**1995.1**				**2001.1**				**2005.1**			
	OV	**UN**	**Na**	**±$5**	**OV**	**UN**	**Na**	**±$5**	**OV**	**UN**	**Na**	**±$5**	**OV**	**UN**	**Na**	**±$5**	**OV**	**UN**	**Na**	**±$5**
P/DPS	13	80	7	33	27	60	13	47	46	54	-	27	80	13	7	20	33	60	7	13
P/EPS	33	60	7	33	33	54	13	20	73	27	-	20	73	27	-	13	67	33	-	20
P/EPO	-	-	100	7	13	67	20	20	73	27	-	20	73	27	-	7	54	46	-	13
P/BVPS	93	7	-	47	20	73	7	33	80	20	-	40	73	27	-	20	20	80	-	7
P/CFPS	20	73	7	20	33	60	7	27	13	87	-	40	87	13	-	7	60	40	-	20
P/NIPS	20	73	7	33	33	60	7	27	13	87	-	7	87	13	-	13	33	60	7	13
P/SPS	13	80	7	13	27	66	7	60	80	20	-	53	87	13	-	7	46	54	-	13
P/TAPS	13	80	7	53	27	66	7	20	80	20	-	47	87	13	-	13	27	73	-	20

Note: OV and UN denote over and under estimated stock prices, NA indicates data were not available or were incomplete to estimate company's stock prices. The numbers in the table are rounded percentages rather than expressed as fractions. P/DPS is price-to-dividend, P/EPS is price-to-earning per, P/EPO is price-to- earnings from operations, P/BVPS is price-to-book value, P/CFPS is price-to-cash flow, P/NIPS is price-to-net income, P/SPS is price-to-sales, and P/TAPS is price-to-assets per share.

Table 4

Performance of Multiplier Techniques in Estimating Share Values of the Dow Jones Utilities Averages Stock Prices Over Different Sample Periods.

	Sample Periods																			
	(1)				(2)				(3)				(4)				(5)			
	1980.1-1984.4				1985.1-1989.4				1990.1-1994.4				1995.1-1999.4				2001.1-2004.4			
Est. For	**1985.1**				**1990.1**				**1995.1**				**2001.1**				**2005.1**			
	OV	**UN**	**Na**	**±$5**	**OV**	**UN**	**Na**	**±$5**	**OV**	**UN**	**Na**	**±$5**	**OV**	**UN**	**Na**	**±$5**	**OV**	**UN**	**Na**	**±$5**
P/DPS	13	80	7	33	27	60	13	47	46	54	-	27	80	13	7	20	33	60	7	13
P/EPS	33	60	7	33	33	54	13	20	73	27	-	20	73	27	-	13	67	33	-	20
P/EPO	-	-	100	7	13	67	20	20	73	27	-	20	73	27	-	7	54	46	-	13
P/BVPS	93	7	-	47	20	73	7	33	80	20	-	40	73	27	-	20	20	80	-	7
P/CFPS	20	73	7	20	33	60	7	27	13	87	-	40	87	13	-	7	60	40	-	20
P/NIPS	20	73	7	33	33	60	7	27	13	87	-	7	87	13	-	13	33	60	7	13
P/SPS	13	80	7	13	27	66	7	60	80	20	-	53	87	13	-	7	46	54	-	13
P/TAPS	13	80	7	53	27	66	7	20	80	20	-	47	87	13	-	13	27	73	-	20

Note: OV and UN denote over and under estimated stock prices, NA indicates data were not available or were incomplete to estimate company's stock prices. The numbers in the table are rounded percentages rather than expressed as fractions. P/DPS is price-to-dividend, P/EPS is price-to-earning per, P/EPO is price-to- earnings from operations, P/BVPS is price-to-book value, P/CFPS is price-to-cash flow, P/NIPS is price-to-net income, P/SPS is price-to-sales, and P/TAPS is price-to-assets per share.