Estimating the magnitude of the MV-IV gap: empirical evidence

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Abstract

This paper documents the magnitude of deviation of common stock market values from intrinsic values estimated using the constant growth dividend valuation model. The constant growth model is widely accepted as a fundamental building block of valuation, and is taught to virtually all undergraduate business students. It is widely accepted as the method by which investors determine the amount they are willing to bid for a share of common stock, based on expected dividend amounts and growth, and their individual required returns. An earlier study (Stretcher-Berg 2004) used aggregated segment data to show that substantial deviations occur between calculated intrinsic values and actual market values (the MV-IV gap). This paper extends that work, estimating the magnitude of the MV-IV gap.

Keywords: MV-IV gap, common stock market values, constant growth dividend, valuation models

Background

Novice investors, experienced investors, investment managers and policy makers all seem to recognize the frequent deviation of prices away from common stock values that would be justified by company 'fundamentals'. At times the magnitude of deviation appears to describe a market that has abandoned reason, bidding stock prices far above rational valuations. In 1996, Alan Greenspan described this as "irrational exuberance" in a report to congress.

A widely taught model of determination of a stock's *intrinsic value* (IV) is the dividend discount model, which uses the discounted cashflow method to arrive at a per-share amount representing the investor's high bid for the stock. The discount rate is the investor's required return, rationally determined as a function of the risk inherent in the stock. Expected dividend growth is estimated based on the investor's observation of past dividend growth and any other information available at the time of bidding. An expected dividend for the first holding period must be specified for the model, often posed as the last dividend paid grown according to the growth rate estimation.

The model utilizes fundamental information concerning the firm's performance (cash dividends and risk) and an academic notion of rationality (on the part of the investor) in processing this fundamental information. With this model, it is possible to accomplish all valuations using the same basic information. Equationally, the intrinsic value is

$$V_{CS} = \frac{D_1}{k_{CS} - g} \qquad \text{Equation 1}$$

where D_1 is the last dividend paid times 1+g, g is the compound growth rate expected for the dividends, and k_{CS} is the required rate of return. The required return can be estimated according to the risk of the stock. The Capital Asset Pricing Model (CAPM) is widely taught as a rational means of estimating one's required return as a function of risk. The CAPM specifies required return as a linear function:

$$k_{CS} = k_j = k_{RF} + \beta_j (k_M - k_{RF}) \qquad \text{Equation 2}$$

In equation 2, k_{RF} is a risk-free rate of return, β_j is the systematic risk measure for stock j, k_M is the rate of return on a market index, and k_M - k_{RF} is the average risk premium for the market index return.

If the intrinsic value model is reasonably accurate in identifying the average price of a stock over time, we might reasonably expect to see market prices deviating above and below the intrinsic value over time, depending on whether the high bidders have overvalued or undervalued the security. At a given point in time, there may exist a market value - intrinsic value gap; the difference between the market price and the intrinsic value of a stock.

The MV-IV gap is calculated as

$$MV_{CS} - IV_{CS} \qquad \text{Equation 3}$$

where MV_{CS} is the price of a stock and IV_{CS} is the calculated intrinsic value of the same stock. Obviously, this could be positive or negative, depending on the magnitude of the values relative to one another. While the dollar value of the gap is meaningful, it may be useful to develop a relative measure of the gap that reflects the magnitude of the gap relative to the calculated intrinsic value. The gap can be stated in terms of a multiple:

$$\frac{MV_{CS}}{IV_{CS}} = MV\text{-}IV \text{ multiple} \qquad \text{Equation 4}$$

This multiple should range between zero and infinity for the data used for this study.

Past Literature

Presumably, common stock valuation is the result of this process of discounting future expected dividends from the investment using a risk-appropriate rate of discount. Assumptions are required concerning the future pattern of dividend levels. This fundamental information is thought, over a long-term equilibrium, to result in an intrinsic value calculation that serves as the basis for the maximum amount an investor is willing to pay for an investment (stock returns appear to be predictable *over the long term* - Campbell 1991, Bekaert and Hodrick 1992). Market prices for these assets should closely reflect the intrinsic value, since investors' bids are supposedly based on that value. A paper by Campbell (2000) traces the development of asset pricing models for the past few decades and presents summaries of the volumes of research involving theoretical models and empirical studies. It highlights that the constant growth and CAPM models, while widely taught, are among many other models of valuation, including other 'fundamental information' type models as well as models that bypass the investor's thought patterns, explaining market prices as either technical results or statistical results.

Several studies (Shiller 1981, Leroy and Porter 1981, others) have documented the volatility of stock prices compared to prices implied by dividend discounting. Evans (1998) relates discounted value of 'expected' future dividends to swings in stock prices, and concludes that dividend growth forecasts predict dividend-price ratios well. Various other studies have inferred significant variations in discount rates from market price fluctuations (Abel 1993, Campbell and Cochrane 1994).

Intuitively, though, we can understand that the real world often does not fit well into the rational theory presented herein. While variation in returns is observable ex-post, uncertainty about the future cannot be foretold. Expectations about future cashflows can be formed but those expectations can be erroneous. Coming up with a valuation model that a rational man would accept as a basis for his bid on a financial asset may not pan out in a market driven by emotions of elation (a bull market) or fear (a bear market).

The deviation of stock values from their intrinsic values has been suggested in a prior study. Stretcher and Berg (2006) aggregated data for 48 industry subgroups originally identified by Fama and French (1997). Using industry variables as inputs for the constant growth model, intrinsic values were compared to market prices, highlighting that intrinsic values rarely mesh with market prices, both for each industry and in the aggregate. This study extends that work by examining valuations of individual securities compared to their market prices. These results provide for an even more rigorous conclusion since firms that do not pay dividends are excluded. For any firm where D_1 is zero, the resulting intrinsic value calculation will equal zero. Obviously, any positive market price would indicate an infinite deviation from the intrinsic value. The objective of this study is to measure the magnitude of the MV-IV gap for firms that *do* pay dividends. Thus, an indication that market prices consistently exceed intrinsic valuations for these firms would be strong evidence that a MV-IV gap exists.

Input Variables for the Constant Growth Model

The common valuation equation for equity investments involves three variables that determine an intrinsic value: cashflow, required return, and an assumed growth pattern for the cashflow. In a steady economic environment, valuation conceivably results in equity value estimates that closely reflect current stock prices. The assumptions common to most financial models assert that, even in absence of stability, the model, on average and over the long term, should reflect averages of stock prices over time. The fact is, though, that significant variation in all three variables occurs. Compound that variation with behavioral specifics not captured by an assumption of a representative 'rational investor', and the result is a questionable valuation model.

In financial models, required returns are estimated using a variety of processes. One of the most common is the Capital Asset Pricing Model (CAPM). Alternative models have been proposed, as well. While these models tend to perform well at aggregate levels (such as describing returns in general or on widely diversified portfolios) their estimates of required returns become less dependable applied at the industry, firm, and project levels (Fama and French, 1997).

Companies (or industries) exist that pay virtually no dividends, and yet have prices reflecting a high and growing dividend (or is it just an extremely low required return?). Fama and French (1999) indicate that these firms represent a large portion of the stock market.

Evans (1998, p. 720) presents some indication that lagged values of dividends alone cannot totally account for the growth expectations of investors. While an expectation of dividends can be based on the current level and a growth expectation, though, in reality nobody can tell the future. Expectations for dividend growth in multiple firms may be more attainable based on historical growth, since positive and negative current signals from firm to firm will tend to offset one another. The ability to calculate a dividend growth forecast based on dividends from the past is reliable. The problem of unpredictable future dividends, however, often is *not* alleviated by the statistical notion of risk used in valuation models.

Other complicating factors exist concerning dividends as well. Companies carry out stock splits and repurchases, affecting per share calculations and market prices. We use adjusted figures for both dividends and prices for our input variables.

Data

All PERMNOs listed in the CRSP database were initial candidates for inclusion in this study. Stocks that do not pay dividends were eliminated from the data set since a zero dividend would result in a zero valuation for that stock. In such cases, any market value would be an infinite proportional departure from the calculated intrinsic value. Many of the more notorious departures from 'fundamental values' during the late 1990's were stocks that had never paid dividends, and had perhaps never had positive earnings. This study focuses entirely on firms that *do* pay dividends.

However, another potential problem existed for firms that pay dividends but for some reason have had a dividend reduction that approaches zero. In order to reduce the effect of declines in dividend payment approaching (but not equaling) zero, a three year moving average dividend calculation was employed to smooth uneven movements in dividend payments. For stocks following a pattern of steady dividend growth anyway, this adjustment made little difference in the calculated growth rate. For stocks with volatile movements in dividend payments, the adjustment had the effect of better indicating a longer term trend rather than an extreme value over the short term.

Dividend growth rates were calculated over a three-year lagged time horizon. The growth rate is the geometric mean of the prior three years' growth rates.

The Capital Asset Pricing Model was used to estimate a required return for each company. A twelve-quarter moving average on the ten-year treasury bond rate was used as a proxy for a risk-free rate (k_{RF}). A forty-quarter moving average S&P 500 return was used for the index return measure (k_M). Scholes-Williams betas were used as the measure of systematic risk. Any observations with missing values for the elements or for the calculation of the required return were dropped from the data set.

The final data set represents data from 1968 through the end of 2002.

Methodology

Intrinsic values were calculated for each stock in the data set, for each year data were available for each stock. For the 6,510 PERMNOs, 51,463 observations resulted. The MV-IV gap was then calculated by taking the market price and subtracting the calculated intrinsic value. Summary statistics were acquired for the MV-IV multiple (from equation 4). Results are presented in table 1, panel 1. On average, the market value is almost 25 times larger than the intrinsic value calculations. In order to control for PERMNOs with very few observations, we re-ran the summary excluding any PERMNOs with fewer than four observations (table 1, panel 2). Still, the market values were almost 21 times larger than intrinsic values.

The large multiple prompted further investigation concerning the ability of the intrinsic value calculations to reflect market values. With a fixed effects panel data model estimated using generalized least squares, the calculated intrinsic value was regressed against the market price. The overall result is presented in table 2. The R^2 of .0003 and the small coefficient and small t-value indicate that we should not reject the null hypothesis that the coefficient is equal to zero.

A similar model was used to see if, although for all firms the relationship does not hold, there may be particular industries where an industry-specific features yield better price-intrinsic value correlation. Two-digit SIC codes from the Bureau of Labor Statistics were used to identify the industry classification for each PERMNO[1]. The results of these GLS regressions are also presented in table 2. For Agriculture-forestry-fishing, Mining, Construction, Manufacturing, Retail Trade, and Services, we fail to reject the null hypothesis that the coefficient is equal to zero. For three industries, a weak relationship was found to exist between intrinsic value and market price. Transportation-communications-electric/gas/sanitary services had a coefficient of .00037 with a t-statistic of 1.68 and a P-value of .093, indicating that at a rejection level of 10% we reject the null hypothesis that the coefficient is equal to zero. The relationship, though, is weak, and the coefficient is close to zero. Wholesale trade had a relatively small number of observations, but had a coefficient of .00566, a t-statistic of 1.77, and a P-value of .077, indicating that we should reject the null hypothesis at a 10% rejection level. The relationship is weak, though, with an R^2 of .0092. Finance-insurance-real estate had a coefficient of .00041, a t-statistic of 1.94, and a P-value of .053, indicating that we should reject the null hypothesis. The R^2, again, is small, and the coefficient is very small, so the result may not be meaningful.

In hopes of finding some relationship between the proportional change in intrinsic value and the proportional change in market price, we regressed the log of the market price against the log of the intrinsic value. The aggregate result (table 3) indicates a significant relationship. Interpreting the coefficient, a 1% change in intrinsic value translates into a .09% change in market price. The direct result appears to be both significant and material.

The coefficient of the log-log model can be interpreted as the elasticity of market price with respect to a change in the intrinsic value:

$$MV = (IV^{a})b \qquad \text{Equation 5}$$

In logs:

$$\ln(MV) = a\ln(IV) + \ln(b) \qquad \text{Equation 6}$$

The total differential is:

$$\left(\frac{1}{MV}\right)dMV = a\left(\frac{1}{IV}\right)dIV + 0 \qquad \text{Equation 7}$$

Therefore:

$$\frac{dMV/MV}{dIV/IV} = a \qquad \text{Equation 8}$$

Again, to see if industry classification would present different results, we repeat the GLS procedure for each of the industry groups (table 3). For all industries but Agriculture-forestry-fishing, we find a similarly strong relationship between the log of intrinsic value and the log of market price. The different result in Agriculture-forestry-fishing may result because of the low number of observations.

Conclusions:

It is indeed a curious result that neither in the aggregate nor by industry can we find strong evidence that there is a relationship between the intrinsic and market values, and this (presumably) coming from a data set limited to observations that seem to meet all the criteria assumed by the model. It appears that this widely accepted and long-taught model is, at the very least, in need of an accompanying disclaimer concerning its lack of congruence with the real world.

It is encouraging, though, that the model is somewhat capable of commentary concerning the elasticity of the market price with respect to the basic dividend, risk, and growth factors in the intrinsic value model. This suggests some direction for future research efforts; perhaps in expanding the elasticity concept or explaining the inability of the model to reflect market values.

Notes:

1. The industry classification for "Public Administration" was omitted since only 11 observations were available.

Table 1.

Variable		Mean	Std. Dev.	Min	Max	Observations
piv	overall	24.75692	275.3405	9.51E-05	25335.17	N = 51463
	between		235.3776	0.003579	6024.04	n = 6510
	within		233.3443	-5989.153	20234.29	T-bar = 7.90522

Variable		Mean	Std. Dev.	Min	Max	Observations
		20.96647	259.8441	0.000195	25335.17	N = 47116
	between		183.0609	0.176718	6024.04	n = 4146
	within		229.7223	-5992.943	20230.5	T-bar = 11.3642

Table 2.

Industry		Coefficient on IV	Constant	Number of Observations*	Number of Firms	Number of Obs. Per Firm: Minimum	Number of Obs. Per Firm: Average	Number of Obs. Per Firm: Maximum	Overall R-sq
All Firms		0.0000185	25.78882	47116	4146	4	11.4	35	0.0003
	s.e.	0.0000906	0.0717468						
	t	0.2	359.44						
	P>|t|	0.838	0						
Agriculture, Forestry, and Fishing		0.005543	23.47823	83	10	4	8.3	21	0.0311
	s.e.	0.023515	1.148065						
	t	0.24	20.45						
	P>|t|	0.814	0						
Mining		-0.0001229	26.25171	1946	180	4	10.8	32	0
	s.e.	0.0003278	0.3768151						
	t	-0.37	69.67						
	P>|t|	0.708	0						
Construction		0.0005657	18.37975	368	45	4	8.2	19	0.0036
	s.e.	0.0008054	0.4878181						
	t	0.7	37.68						
	P>|t|	0.483	0						
Manufacturing		-0.0001561	28.10337	19267	1557	4	12.4	35	0.0001
	s.e.	0.0001246	0.1205517						
	t	-1.25	233.12						
	P>|t|	0.21	0						
Transportation, Communications, Electric, Gas, and Sanitary Services		0.0003727	27.07279	6393	369	4	17.3	35	0.0004
	s.e.	0.0002218	0.1788493						
	t	1.68	151.37						
	P>|t|	0.093	0						
Wholesale Trade		0.0056621	21.12508	1320	109	4	12.1	30	0.0092
	s.e.	0.0031995	0.2408358						
	t	1.77	87.72						
	P>|t|	0.077	0						
Retail Trade		-0.0014713	22.43323	2725	250	4	10.9	34	0.0041
	s.e.	0.0026099	0.2352622						
	t	-0.56	95.35						
	P>|t|	0.573	0						
Finance, Insurance, and Real Estate		0.0004105	23.07	12809	1398	4	9.2	35	0.0006
	s.e.	0.0002119	0.1243822						
	t	1.94	185.48						
	P>|t|	0.053	0						
Services		0.0012994	25.8067	2079	209	4	9.9	27	0.0091
	s.e.	0.0016969	0.5082248						
	t	0.77	50.78						
	P>|t|	0.444	0						

* The sum of the observations from each industry does not equal 47116 because there are 115 observations with an SIC of zero and 11 observations with an SIC of 9511 (Public Administration). Eleven observations is not enough to estimate the model.

Table 3.

Industry		Coefficient on Ln(IV)	Constant	Number of Observations*	Number of Firms	Number of Obs. Per Firm			Overall R-sq
						Minimum	Average	Maximum	
All Firms		0.091204	2.795218	47116	4146	4	11.4	35	0.1823
	s.e.	0.0016259	0.003644						
	t	56.09	767.07						
	P>|t|	0	0						
Agriculture, Forestry, and Fishing		0.0129865	2.897664	83	10	4	8.3	21	0.0499
	s.e.	0.034265	0.0561266						
	t	0.38	51.63						
	P>|t|	0.706	0						
Mining		0.1317241	2.755877	1946	180	4	10.8	32	0.2627
	s.e.	0.0075082	0.0145609						
	t	17.54	189.27						
	P>|t|	0	0						
Construction		0.06909	2.526484	368	45	4	8.2	19	0.1395
	s.e.	0.0171975	0.0304577						
	t	4.02	82.95						
	P>|t|	0	0						
Manufacturing		0.0924464	2.879765	19267	1557	4	12.4	35	0.236
	s.e.	0.002537	0.005393						
	t	36.44	533.98						
	P>|t|	0	0						
Transportation, Communications, Electric, Gas, and Sanitary Services		0.0489331	3.000982	6393	369	4	17.3	35	0.0784
	s.e.	0.0040777	0.012205						
	t	12	245.88						
	P>|t|	0	0						
Wholesale Trade		0.0866929	2.722378	1320	109	4	12.1	30	0.1982
	s.e.	0.0085157	0.0165745						
	t	10.18	164.25						
	P>|t|	0	0						
Retail Trade		0.1021994	2.674538	2725	250	4	10.9	34	0.1632
	s.e.	0.0075505	0.0141392						
	t	13.54	189.16						
	P>|t|	0	0						
Finance, Insurance, and Real Estat		0.1007431	2.64457	12809	1398	4	9.2	35	0.1547
	s.e.	0.0031639	0.007518						
	t	31.84	351.76						
	P>|t|	0	0						
Services		0.084069	2.777414	2079	209	4	9.9	27	0.1527
	s.e.	0.0084258	0.0147283						
	t	9.98	188.58						
	P>|t|	0	0						

* The sum of the observations from each industry does not equal 47116 because there are 115 observations with an SIC of zero and 11 observations with an SIC of 9511 (Public Administration). Eleven observations is not enough to estimate the model.

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