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An “Enhanced” Corporate Valuation Model: Theory and Empirical Tests

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Abstract

In this paper, we develop an enhanced corporate valuation model based on the implied cost of equity capital (ICC). We argue that the enhanced approach extends the standard market multiples and discounted cash flow (DCF) approaches to corporate valuation. Specifically, it incorporates positive aspects of the market comparables and DCF approaches while mitigating the shortcomings of both. Unlike the traditional market comparables approach, the enhanced approach takes account of the full term structure of earnings forecasts. It does so by using the ICC calculated for the comparable companies as an "enhanced multiple" which translates the entire stream of cash flow forecasts into a value estimate. Unlike the DCF approach it does not require estimation of the cost of equity capital. As such, it avoids the complexity and uncertainty associated with estimating the cost of equity capital. In our empirical tests, we find the enhanced approach to be more accurate than either of the two traditional approaches.

1. Introduction

Traditionally appraisers have employed two fundamental approaches to corporate valuation. A market comparables approach based on valuation ratios and discounted cash flow (DCF). In this paper we develop an "enhanced" valuation model that uses the implied cost of capital, or ICC, to combine elements of both the traditional approaches. We then discuss reasons why this enhanced approach is likely to be more accurate than either of the two standard approaches. Finally, we conduct empirical tests designed to test this conjecture.

Throughout the paper, we assume that cash flow forecasts (or equivalently expected future cash flows) are given. While the outcome of a valuation analysis is critically dependent upon the cash flow forecasts, the development of those forecasts is generally separate from the financial valuation analysis. For example, forecasts are often based on analyst reports or on management projections. Though we take these forecasts as given, we do analyze how possible errors or biases in the forecasts affect the operation of valuation models and note how the enhanced model ameliorates the impact of such errors and biases.

To set the stage for our analysis, recall briefly the steps taken in the traditional market comparable and DCF approaches.[1] The market comparable approach begins with the identification of publicly traded companies deemed to be comparable to the appraisal

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[1] Our description of the traditional approaches is very brief because they are so well known. More detailed discussions are available in any of the leading valuation texts including Damodaran (2012), Holthausen and Zmijewski (2014) and Pratt (2008).

target.[2] Using the observed market values of the comparable companies, valuation ratios, such as price/earnings and EBITDA/enterprise value, are calculated for the comparables. When the data are available, the ratios are typically based on both forecast future earnings and last twelve months (LTM) historical earnings. Of the two measures, forecast future earnings are typically preferred because they are forward looking and they exclude the impact of idiosyncratic one-time events. The individual ratios for the comparable companies are then aggregated, often simply by taking the average or the median. Finally, the aggregated ratio is applied to the target company to arrive at the value indicator.

Though straightforward, the standard multiple valuation approach has two deficiencies. First, it is based exclusively on short-term earnings, either LTM or one-year forward forecasts. As such, it does not take into account the full term structure of earnings forecasts, which in most cases are available out to five years. Second, the analysis fails to explicitly take account of the impact of discounting.

In comparison, the DCF approach uses the entire term structure of earnings forecasts. Those forecasts are used to produce estimates of expected future cash flows up to a terminal horizon determined by the availability of the forecast data which is most typically three to five years. When the forecasting horizon is reached, additional assumptions are made regarding more distant cash flows in order to estimate the continuing value at the terminal horizon. To compute the present value of the forecast future cash flows and the continuing value a discount rate is required. That discount rate

[2] The approach can also use recent acquisitions, but that raises the issue of control premiums. Here we focus on publicly-traded comparables to avoid distracting complications. However, the enhanced model can also be applied to comparable acquisitions.

is typically estimated by applying an asset pricing model, such as the CAPM or the Fama-French three factor model, to data for the comparable companies to build up an equity cost of capital. The target company cost of equity is then estimated by averaging (in some fashion) the estimates for the comparable companies with an adjustment for leverage if deemed necessary. Finally, if the entity being valued if is a company's operating enterprise, as opposed to its equity, the cost of equity is incorporated into a Weighted Average Cost of Capital ("WACC") that includes the observed cost of debt. The WACC serves as the discount rate.

The most significant problem with the DCF approach, other than the forecasting the future cash flows, is that estimation of the cost of equity is controversial. It requires, at a minimum (1) determining what asset pricing model to use; (2) choosing what risk factors to include; (3) selecting a sample of companies; (4) selecting an estimation period; (5) choosing the observation interval; and separately (6) estimating the required risk premia.

In this paper we propose and test empirically an enhanced valuation model based on application of the ICC. We argue that the enhanced approach incorporates positive aspects of the market comparables and DCF approaches while mitigating the shortcomings of both. Unlike the traditional market comparables approach, the enhanced approach takes account of the full term structure of earnings forecasts. It does so by using the ICC calculated for the comparable companies as an "enhanced multiple" which acts as a discount rate to translate cash flow forecasts into a value estimate. As such, it avoids the complexity and uncertainty associated with estimating the cost of equity capital. Seen in this light, although the ICC acts like a discount rate, it need not be equal to the cost of capital. In our view, it is more appropriate to think of the ICC as an enhanced multiple that converts the entire future stream of cash flow forecasts, not just one year, into an estimate of value. The reason for this interpretation is easier to appreciate once the model has been developed.

2. Towards an Enhanced Valuation Model

The enhanced procedure that we suggest begins, like the market multiples approach, with identification of publicly traded companies deemed comparable to the valuation target. In this instance, we use companies within the same SIC code (as discussed later) as comparables. Instead of computing valuation ratios, however, the enhanced procedure starts with estimates of the ICC for the comparable companies. Next, whereas the market multiple approach applies the average or median valuation multiple to the target company to estimate its value, the enhanced approach uses the average or median ICC as a discount rate, wherein the value of a subject firm is estimated as the present value of projected cash flows discounted using the ICC calculated from the comparable companies.[3]

Because the target's ICC is derived from the comparable companies, the quality of the enhanced model, like the standard multiples model depends on the comparability of firms used to estimate the ICC. Unlike valuations based on standard ratios, however, the enhanced model takes account of the full term structure of earnings forecasts (that is all the forecasts out to the terminal horizon and the continuing value) as well as the

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[3] See, for example, Gebhardt, Lee and Swaminathan (2001) which applies the Olson model based on excess earnings to compute the ICC. The choice of model is largely irrelevant as long as the same model is applied to the comparables and the target company.

impact of discounting. In this sense, the enhanced approach is similar to the DCF approach. Unlike the traditional DCF model, though, there is no need to build up the cost of equity using an asset pricing model. The ICCs are calculated directly from the comparable companies.

As noted previously, one way to interpret the approach is as simply a DCF model using the ICC from the comparables as the cost of equity. But the approach is more general than that. The ICC is better interpreted as defining a mapping from projected cash flows to value. Assuming that the comparable companies are in fact sufficiently comparable, the mapping works just like a valuation ratio (such as P/E) works in standard multiple models. What sets the enhanced approach apart is that it maps the entire term structure of forecasts, and not just one year, into value.

The interpretation of the ICC as enhanced multiple becomes important when the possibility of bias and errors in the forecasts are introduced. In this regard, there is a body of work in the accounting literature that warns against using the ICC to estimate the cost of equity capital because of biases in the inputs. Most prominently, if the ICC calculation is based on upward-biased (downward-biased) analyst earnings forecasts then it will overstate (understate) the cost of equity capital. For example, an empirical study by Easton and Sommers (2007) finds that the ICC is indeed an upward biased estimate of expected returns when it is calculated using analysts forecasts as inputs.

The critical point to recognize is that using the ICC to estimate the cost of capital is not same thing as using it as an enhanced multiple to map cash flow forecasts to value. Surprisingly, when there are biases in forecasts, the enhanced approach based on the ICC will generally produce a more accurate value indicator even though the ICC is a biased measured of the true cost of equity. The best way to illustrate why this is so is with a simple example. Suppose, as Easton and Sommers (2007) find, that analyst forecasts are optimistic and that as a result the ICC overstates the cost of equity capital. This will not produce valuation errors when applying the enhanced model as long as the bias is consistent across companies. Due to the bias, the ICC for the target company calculated from the comparable company ICCs will overstate the true cost of equity capital, but the forecast earnings for the valuation target will be biased upward as well. If the bias in the forecasts is the same for the comparable companies and the target, the two effects will cancel. Put another way, the target ICC overstates the cost of capital by precisely the right amount to offset the upward bias in the target company's forecast earnings. As a result, the estimate of value is more accurate than either the estimate of the cost of capital or the forecasts of future earnings.

This result holds not only for bias in earnings forecasts, but for other potential errors in other valuation inputs as well. For instance, suppose that an appraiser consistently underestimates long-term growth when calculating the terminal value.[4] The result will be a downward bias in the appraiser's estimates of the ICCs for the comparable companies and, thereby, the cost of equity for the target. However, there will be an offsetting downward bias in the target company's terminal value.

Notice that in the foregoing examples, if a more accurate estimate of the cost of equity capital had been used in place of the ICC, the resulting valuation would have been *worse* because there would be no offset to the bias in the forecasts. To be fair, it should

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[4] This would be akin to underestimating the long-run ROE in the model we use to estimate ICC. See equation 1 below.

be noted that this self-cancelling feature is not unique to the ICC approach. It also holds for comparable company appraisals based on standard valuation ratios. However, the traditional multiples approach suffers from the deficiencies discussed earlier.

The bottom line is that the accuracy of the enhanced approach does not depend on the ICC being a better estimate of the cost of capital than that provided by an asset pricing model. If there are errors or biases in the forecasts, the self-canceling aspect of the enhanced approach can produce value estimates that are more accurate than those produced by a DCF model. The extent to which this occurs in the real world is, of course, an empirical question that we turn to next.

Before that, there is one more related benefit of the enhanced approach that is worth noting. As Damodaran (2014) observes, when the cost of capital for the comparable companies is built up using an asset pricing model it introduces an inconsistency because unless the estimated cost of equity for the comparables equals their ICCs, applying the DCF model to the comparables will yield estimated values that differ from their observed market prices in contradiction to the fair market value standard. The enhanced model avoids this inconsistency because by definition the estimated value equals the market price as long as the procedure used to discount the target cash flows is the same as the one used to estimate the ICC.

3. Initial empirical tests of the enhanced approach

To operationalize and test the enhanced model, the first step is choosing a procedure for calculating the ICC. Here we follow the approach taken by Gebhardt et al (2001) because it is apparently the most widely adopted. As noted above, it is worth stressing that as long as the ICC is estimated consistently for both the comparable companies and the valuation target, the results are not likely to be sensitive to the precise calculation procedure.[5]

Gebhardt et al use a standard residual income model ("RIM", a version of the DCF model) to estimate the ICC. More specifically, using on equation (1) below (reproduced from Gebhardt et al equations 5 and 6), the authors define the ICC as the discount rate that equates the observed equity value of the firm with the present value from the residual income model:

$$P_t = B_t + \frac{FROE_{t+1} + r_e}{(1+r_e)} B_t + \frac{FROE_{t+2} + r_e}{(1+r_e)^2} B_{t+1} + TV \quad (1)$$

$$TV = \sum_{i=3}^{T-1} \frac{FROE_{t+1} - r_e}{(1+r_e)^i} B_{t+i-1} + \frac{FROE_{t+T} - r_e}{r_e(1+r_e)^{T-1}} B_{t+T-1}$$

where, B_t = book value from the most recent financial statement
r_e = cost of equity
$FROE_{t+i}$ = forecasted ROE for period t+i
B_{t+i} = forecasted dividend per share for year t+i
TV = Terminal value

We employ the above formula in a manner similar to how it is employed by Gebhardt et al. (with a few modifications) as follows:

- We use a three-stage model. The first stage covers the first five years of the projection, the second stage covers years 6 through 15, and the third stage covers the terminal years.
- We estimate the ROE for each company for the first five years based on the projected EPS for each company. We use the consensus analyst EPS

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5 We reiterate that if the ICC is interpreted as a discount rate, rather than an enhanced model, then the method by which is calculated is likely to be more critical.

projections (which often go out two to three years) as reported S&P CapitalIQ where available; otherwise we estimate forward EPS as equal to the most recent EPS grown using analyst forecasts for the long-term EPS growth for that company. We then estimate the ROE for the first five years of the projection as equal to the projected EPS divided by projected BV, which we calculate using the starting BV, projected EPS, and projected dividend payout ratio (see below). Next, we assume that the long-run ROE used in calculating the terminal value is equal to the median industry ROE over the five years preceding the date of analysis, wherein we define industry as firms within the same 4-digit SIC code. When estimating the long-run ROE, we only use firms which have positive ROE in the five years preceding the calculation date, and 4-digit SIC codes with at least five firms in the subset. We use the four-SIC codes assigned to each firm as reported by CRSP immediately prior to each calculation date. In this exercise, we then control for outliers by deleting observations when the estimated ROE in the first five years of the projection is greater than 100%. Finally, we estimate the ROE for years six to 15 for each firm by linearly interpolating between the ROE in year 5 and the estimated long-run industry ROE.

- Similarly, we assume that the future annual dividend payout ratio for each firm as of each valuation date equals the median industry payout ratio over the five years preceding the date of analysis, based on dividend payout ratios of firms with at least three years of data preceding the valuation date. We delete observations wherein the historical estimated industry-average dividend payout ratio is negative, and if the estimated payout ratio is greater than 100%, we reset it to 100% (although this happens very rarely in our sample).

Gebhardt et al do not adjust their equations for the potential effect of leverage. Although theory implies that the cost of equity depends on the extent of leverage, making a leverage adjustment requires application of an asset pricing model which reintroduces the joint problems of choosing the asset pricing model to apply and the determining precise leveraging formula to apply. Furthermore, work by Levi and Welch (2014) suggests that leverage adjustments do little to increase the accuracy of cost of equity estimates. In light of this conundrum, we too ignore the effects of leverage.

Recall that we build cash flow forecasts from industry analyst projections and historical information, and for the purposes of our exercise these cash flow forecasts are taken as given. As a result, for the enhanced model to produce different valuation estimates than the DCF model, it must be the case that the ICCs differ systematically from standard estimates of the costs of equity capital. As a first step, therefore, we examine whether there are systematic differences between the ICCs that we calculate and estimates of the cost of equity derived from the CAPM.

Unfortunately, there is no “standard” CAPM procedure for estimating the cost of equity. It depends on factors such as the choice of the risk-free rate, the Beta estimation procedure, the estimation of the market risk premium, and the decision of whether to add an adjustment such as the size premium. In light of this problem, we use what in our experience has been the most widely adopted procedure in appraisal practice. Specifically, we use the yield on the 20-year U.S. Treasury bond as the risk-free rate, a Beta estimated using an OLS regression based on five years of monthly data, and the supply-side equity risk premium (ERP) reported in the most recent Ibbotson yearbook available as of the estimation date.

Next, we turn to direct comparisons of the three valuation methods: standard market multiples, DCF and the enhanced model. What makes comparative tests difficult to implement is that the results depend on how each method is implemented. To avoid the appearance of cherry picking, we use the well-known paper by Kaplan and Ruback (1995) as a blueprint and attempt to make our implementations of the market comparables and DCF techniques as "vanilla" as possible. We implement the enhanced approach using the Gebhardt et al method described above.

4. Description of the Sample

For our empirical study, we use data for the years from 2007 through 2014. The calculations on which we base our tests are done as of September 30 for each year. Included in the sample are all NYSE/AMEX/NASDAQ-listed securities in the Center for Securities Prices ("CRSP") data at the University of Chicago's Booth School of Business. For each company in our sample, as of the date of the calculations, we obtained from CRSP the permno, permco, CUSIP, ticker, company name, size decile assignment, and SIC code. Starting with this sample, we then obtain from S&P Capital IQ the market capitalization, shares outstanding, weighted average shares outstanding, share price, dividends per share, book value per share, total book value, total debt, EPS for the preceding five years, projected EPS, estimated long-term EPS growth rate, and equity Beta.

We merge the two datasets by CUSIP and delete the following observations which appear to either outliers or errors:

- Those with equity Betas greater than 100 or less than zero.

- Those with LTM and Forward P/E ratios greater than 300.

The final sample, which is the intersection of the two data sets, after eliminating certain observations as discussed above, is reported in Table 1. We break out the size deciles because we use them is some of our empirical tests.

Table 1: Number of Companies in Sample

Decile	2007	2008	2009	2010	2011	2012	2013	2014
1	102	107	100	113	109	113	120	127
2	104	106	92	115	106	118	110	123
3	98	89	77	103	113	98	100	100
4	95	91	91	99	103	103	109	110
5	98	106	87	104	106	98	105	100
6	108	127	89	114	123	101	124	116
7	143	120	102	128	132	128	121	114
8	148	147	100	139	126	113	127	129
9	220	172	130	166	149	163	137	105
10	196	163	102	149	134	109	141	85
Total	1312	1228	970	1230	1201	1144	1194	1109

5. Empirical Results

Because the enhanced model differs from the standard DCF model only if the ICC differs from the CAPM cost of equity, we begin our empirical analysis with a comparison of the two measures. For each company in our sample, we compute the ICC using the Gebhardt et al procedure described above. To compute the CAPM cost of equity, we obtain the equity Beta from S&P CapitalIQ wherein we choose the OLS regression using three to five years of monthly returns, the S&P 500 as the market benchmark, the yield on the 20-year U.S. government bond as the risk-free rate, and the supply-side risk premium reported by Ibbotson as the ERP.

Table 2 presents the results of a comparison of the ICC with CAPM estimates of the cost of equity, using only firms for which we can estimate both. The most important thing to note is that the two sets of numbers are clearly different. This means that the enhanced approach will produce value indicators that differ from those produced by the standard DCF model. Because of a history of including a "size" premium in DCF valuations, the results are reported by decile. Notice that the general conclusion that the ICCs differ from the CAPM estimates of the cost of equity holds for every decile.

Table 2A: Median ICC Estimates

Decile	2007	2008	2009	2010	2011	2012	2013	2014
1	9.45%	11.02%	10.44%	9.66%	9.66%	9.28%	8.17%	8.41%
2	8.37%	10.85%	9.86%	9.05%	9.43%	8.79%	7.59%	7.56%
3	8.13%	10.36%	9.41%	8.79%	8.56%	8.48%	7.79%	7.65%
4	8.21%	10.29%	9.63%	9.18%	8.52%	8.89%	7.46%	7.57%
5	8.53%	10.30%	9.35%	8.73%	9.34%	8.61%	8.40%	7.71%
6	8.70%	10.06%	9.69%	8.70%	9.29%	8.40%	7.57%	7.36%
7	8.40%	10.51%	9.38%	9.15%	8.89%	8.58%	7.43%	7.65%
8	9.01%	10.16%	9.45%	8.92%	9.69%	8.73%	7.72%	8.36%
9	8.95%	10.15%	9.96%	9.48%	9.34%	9.61%	8.22%	8.17%
10	9.59%	12.52%	10.73%	10.80%	10.40%	9.83%	7.95%	8.78%

Table 2B: Median CAPM Estimates

Decile	2007	2008	2009	2010	2011	2012	2013	2014
1	10.61%	10.56%	9.78%	8.66%	8.74%	8.53%	9.74%	9.41%
2	11.05%	11.63%	10.22%	9.17%	9.40%	8.74%	9.67%	9.31%
3	10.87%	11.16%	10.35%	8.91%	9.64%	9.13%	9.76%	9.47%
4	11.29%	11.90%	9.58%	8.87%	9.38%	9.82%	9.96%	9.84%
5	11.46%	11.96%	10.31%	9.97%	9.65%	9.22%	11.69%	10.60%
6	11.71%	11.57%	9.88%	9.02%	10.33%	9.75%	10.33%	10.29%
7	11.95%	12.26%	10.15%	9.30%	9.40%	9.56%	10.43%	11.55%
8	14.05%	12.42%	10.40%	9.27%	10.99%	10.13%	10.80%	10.09%
9	12.58%	11.79%	11.41%	9.48%	9.84%	10.00%	11.28%	10.67%
10	11.13%	11.93%	10.40%	9.54%	10.44%	9.04%	10.13%	10.39%

Further study of Table 2 reveals that the important reason for the difference between the two sets of estimates is that the CAPM cost of equity does not increase much from 2007 to 2008 whereas the ICC estimate rises sharply with the onset of the financial crisis. After 2008, the ICC falls continuously up until 2013. While the CAPM cost of equity also declines, the amount is small compared to the drop in the ICC. The decline in the CAPM estimate is due almost entirely to the drop in the twenty-year Treasury bond rate over that time period. The difference between the two sets of estimates points to a potential problem with the CAPM cost of equity. Overall, the average CAPM cost of equity can drop only if the risk-free rate or the equity risk premium falls. However, when historical data are used to estimate the equity risk premium it is effectively pinned down and can change only by small amounts from year to year. If, in fact, the true but unobservable market risk premium changes, the CAPM estimation using an historical market risk premium will not pick up the change. The ICC, on the other hand, being a forward looking measure calculated from market prices, will immediately reflect any change in the risk premium. As a result, if changes in risk premiums are an important element of the movement in market prices, as may well have been the case during and following the 2008/2009 financial crisis, then the enhanced valuation model is likely to produce more accurate value indicators than a traditional DCF model that relies on historical return data to estimate the discount rate.

To test the foregoing conjecture, and more generally to compare the enhanced model with the standard DCF and market multiples models, we begin with estimating the firm equity values for all the companies in our sample using the enhanced approach based on the ICC, the standard multiple approach based on P/E ratios, and the DCF model using the CAPM cost of equity.

Equity Value Estimates Based on the ICC

For all companies in our sample for whom we can estimate ICC, we do so using equation (1). At each annual calculation date of September 30, we start with the most recent consensus estimates for EPS and the long-term EPS growth forecasts by industry analysts for each firm to develop projections for the first five years of the projection period. We use each company's median dividend payout ratio (after eliminating dividend payout ratios less than zero and greater than 100%) over the previous three to five years (depending on the availability of data) to estimate dividend payouts for the first five years of the projection period. We estimate the book value at the end of each year for the first five years of the projection period using the starting book value (i.e., as of each date of analysis) and the EPS projection and dividend payout ratio. From year 6 to 15 of the projection period, we linearly interpolate between the ROE at the end of year 5 and the long-run industry ROE, which we estimate as equal to the median ROE for the industry over the five years preceding the date of analysis (wherein we use firms in the same 4-digit SIC code and with at least three years of data).

Having calculated the ICCs for each firm in our sample, we proceed as follows. For each 4-digit SIC code, we pick one company as the target and the others as the comparables. We use the median ICC of the comparables to value the target by applying the ICC calculated for the comparable companies. This is our enhanced estimate of value for the target. We then repeat the analysis using the next firm in the same 4-digit SIC classification as the target. We continue in this fashion until all of the firms in that SIC classification have been used as the target. The same calculations are done for all 4-digit SIC classifications.

Equity Value Estimates Based on P/E Ratios

For all companies in our sample for which the necessary data are available, we use the analyst consensus one-year forward EPS and the market price as of September 30 to calculate the forward P/E ratio. We then proceed precisely as we did for the ICC value calculations. That is for each 4-digit SIC classification, we pick a target company and uses the remaining companies as comparables. We calculate the median forward P/E ratio for the comparables and use it to value the target. We do the calculation for every firm in each 4-digit classification and for and the 4-digit classifications.

Equity Value Estimates Based on a DCF Model Using the CAPM Cost of Equity

For all companies in our sample for which the necessary data are available, we use the CAPM estimates cost of equity reported previously. Using the CAPM discount rate, we then calculate the equity value for each firm using equation (1) so as to be directly comparable to the ICC based valuations. The DCF value indicator is simply the present value of the terms in equation (1) discounted at the cost of equity.

To assess the accuracy of the three competing measures, we begin by calculating the log of the ratio of the estimated value to the actual value for each firm as of the observation date of September 30 for each year from 2007 to 2014.[6] The log ratio is symmetric, i.e., agnostic as to whether the methodology over- or under-estimates the value, and can be interpreted as the estimation error (presented in percentage).

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[6] The metrics we report here are similar to those used by Kaplan and Ruback (1995).

Table 3 presents statistics designed to compare the accuracy to the value indications using the three methods for firms for which we can implement all three. The results are informative in several respects.

Table 3: Summary of Errors in ICC, P/E, and CAPM Methodologies

Year	N	Median	Mean	Standard Deviation	Interquartile Range	Mean Absolute Error	Mean Squared Error	Percent Within +/- 15%
Errors in ICC Methodology								
2007	1,285	-0.1%	1.7%	38.4%	38.4%	24.7%	14.0%	40.5%
2008	1,208	-0.1%	4.8%	48.8%	53.8%	34.6%	24.2%	29.8%
2009	954	0.2%	1.2%	33.5%	38.9%	25.1%	11.1%	40.5%
2010	1,216	0.1%	1.3%	38.9%	41.9%	28.1%	15.0%	38.7%
2011	1,178	0.1%	0.3%	41.8%	47.4%	30.3%	17.3%	34.7%
2012	1,137	0.0%	0.5%	43.0%	43.0%	28.9%	18.5%	37.5%
2013	1,184	0.1%	-0.3%	40.2%	38.9%	26.8%	16.2%	39.9%
2014	1,086	0.3%	0.2%	42.0%	40.8%	27.9%	17.7%	40.2%
Errors in P/E Methodology								
2007	1,285	-0.1%	-5.9%	52.4%	45.7%	33.8%	27.8%	37.0%
2008	1,208	0.1%	-5.3%	60.8%	59.3%	41.3%	37.2%	28.3%
2009	954	0.6%	-9.0%	59.2%	57.9%	41.6%	35.8%	31.2%
2010	1,216	0.4%	-7.9%	59.5%	56.4%	41.1%	36.0%	29.5%
2011	1,178	0.1%	-6.7%	56.2%	55.5%	39.6%	32.0%	29.9%
2012	1,137	0.4%	-6.2%	54.6%	52.8%	38.7%	30.1%	31.9%
2013	1,184	1.0%	-7.1%	52.3%	48.1%	35.9%	27.8%	35.1%
2014	1,086	0.0%	-8.3%	49.9%	47.3%	34.2%	25.5%	35.1%
Errors in CAPM Methodology								
2007	1,285	-53.0%	-83.3%	135.6%	164.6%	113.4%	253.2%	12.7%
2008	1,208	-5.8%	-13.9%	82.7%	100.2%	62.4%	70.2%	18.1%
2009	954	-1.4%	-10.5%	85.2%	103.5%	65.9%	73.5%	16.5%
2010	1,216	4.6%	0.9%	84.7%	100.6%	65.2%	71.8%	15.1%
2011	1,178	-6.7%	-6.0%	83.9%	100.3%	64.2%	70.7%	15.5%
2012	1,137	-11.0%	-10.5%	91.4%	102.6%	68.3%	84.5%	15.3%
2013	1,184	-52.6%	-55.7%	93.1%	103.7%	81.7%	117.6%	12.3%
2014	1,086	-44.8%	-47.5%	90.2%	98.4%	77.4%	103.8%	12.0%

The most dramatic finding is that the DCF approach using the CAPM cost of equity produces decidedly inferior estimates of value across all our measures. To begin, in most of the years there is significant bias in the DCF estimates. This appears to be caused by the failure of the DCF model to reflect variation in risk premiums that apparently occurred during the sample period. In comparison, both the enhanced and multiples methods produce valuations errors whose mean and median are close to zero. The valuation errors for the enhanced model in particular are tightly clustered around zero. We note, however, that average valuation errors clustering around zero is not necessarily indicative of a superior approach if the method also yields large errors in either direction.

To address the foregoing concern, Table 3 also reports measures of central tendency: the standard deviation, the interquartile range, the mean absolute error, the mean square error, and the percentage of estimates with 15% of the observed value. Because all of these measures reflect the same underlying phenomenon they tend to be highly correlated.

According to every measure of central tendency, the DCF model does markedly worse than the other two. The standard deviation of the forecasts errors is uniformly larger as are the mean absolute error and the mean squared error. Furthermore, the interquartile range is much greater and the value estimates within 15% are much smaller.

As noted previously, the failure of the DCF approach is likely less the fault of the model rather than how it was implemented. Had the DCF model relied on an equity risk premium computed using forward looking data, it likely would better reflect changes in the risk premium that characterized this period and would, therefore, produce more accurate valuation estimates. This is further evidence of the point stressed by Cochrane (2011) in his Presidential Address to the American Finance Association that equity market risk premia should not be treated as constant.

Moving on to a comparison of the enhanced and multiples approaches, the differences are smaller. The mean and median errors are closer to zero for the enhanced approach, but not by a large margin as was the case for the DCF. The measures of central tendency are also similar, but the enhanced model does perform slightly better on most of them.

The bottom line is that the results confirm our conjecture that the enhanced model is a valuable addition to an appraiser's toolkit. In our empirical tests it dramatically outperforms the DCF approach and is slightly superior to the standard multiples approach.

As a final check on the results we perform one added set of tests. It is possible that the aggregate results reported in Table 3 are driven by smaller firms. This is a potential problem because our tests rely on analyst forecasts and far fewer analysts follow such companies. In addition, many small firms have negative predicted earnings which makes the estimation of the ICC more sensitive to variation in the forecasts. Finally, SIC classification may be less appropriate as a means of assessing comparability for such firms. For all these reasons, we repeat our calculations using only companies in deciles 1 and 2.

The results for the sample restricted to larger firms are reported in Table 4. The table shows that once again that both the enhanced model and the standard multiples model dramatically outperform the DCF approach. The problems discussed previously that bedevil the DCF model continue to be an issue when the sample is limited to large firms.

Table 4: Summary of Errors in ICC, P/E, and CAPM Methodologies for Companies in Deciles 1 and 2

Year	N	Median	Mean	Standard Deviation	Interquartile Range	Mean Absolute Error	Mean Squared Error	Percent Within +/- 15%
Errors in ICC Methodology								
2007	205	-4.1%	-6.5%	28.4%	34.9%	21.98%	8.44%	44.39%
2008	213	-6.5%	-4.1%	38.2%	42.9%	28.76%	14.71%	36.15%
2009	191	-5.1%	-5.7%	27.3%	30.0%	20.49%	7.74%	50.26%
2010	228	-3.0%	-3.6%	31.3%	36.9%	23.68%	9.86%	41.67%
2011	213	-1.2%	-5.5%	36.3%	46.4%	27.95%	13.44%	36.15%
2012	230	-4.1%	-3.9%	53.1%	38.8%	27.83%	28.22%	39.57%
2013	228	-0.7%	-1.6%	51.1%	35.2%	25.46%	26.05%	42.11%
2014	247	-3.6%	-3.8%	51.1%	36.6%	26.57%	26.14%	40.49%
Errors in P/E Methodology								
2007	205	6.1%	3.5%	36.1%	36.6%	25.59%	13.12%	43.41%
2008	213	7.2%	3.6%	43.0%	42.8%	31.61%	18.52%	34.27%
2009	191	8.1%	-2.3%	47.8%	50.3%	33.92%	22.79%	35.60%
2010	228	10.8%	8.5%	38.5%	48.3%	30.54%	15.48%	29.82%
2011	213	7.7%	4.3%	44.2%	41.6%	31.38%	19.61%	34.27%
2012	230	5.6%	1.3%	43.2%	40.5%	31.16%	18.58%	35.22%
2013	228	12.1%	7.8%	39.6%	38.2%	29.06%	16.24%	33.33%
2014	247	6.2%	-1.2%	45.2%	37.7%	29.79%	20.35%	37.65%
Errors in CAPM Methodology								
2007	205	-24.9%	-44.8%	107.3%	111.2%	80.79%	134.54%	15.12%
2008	213	5.8%	-1.1%	77.9%	75.6%	55.70%	60.36%	26.76%
2009	191	7.8%	3.4%	77.7%	94.9%	59.86%	60.10%	18.85%
2010	228	20.7%	14.1%	80.4%	100.5%	62.59%	66.30%	14.91%
2011	213	18.6%	15.4%	77.9%	96.4%	61.20%	62.71%	13.62%
2012	230	5.5%	10.5%	96.3%	96.9%	67.35%	93.36%	13.48%
2013	228	-31.9%	-34.1%	92.0%	98.2%	69.94%	95.95%	12.72%
2014	247	-28.6%	-24.5%	89.0%	88.3%	65.47%	84.82%	15.79%

When the enhanced approach and the multiples approach are compared for large firms, the two turn out to be remarkably similar across all of our measures. In some years and for some measures, the enhanced model comes out on top while in other years the multiples model is the winner. Overall, there is no clear evidence that one model is superior to the other. We find this surprising because as stressed earlier the multiples model relies only a one-year forecast, whereas the enhanced model takes account of the entire stream of earnings forecasts. One possible explanation for the similarity between the two approaches is that for larger firms with a long track record of earnings the analyst projections can be approximated by extrapolating past growth. In that case, the full stream of projected earnings may provide little information in addition to that impounded in the multiple and next year's forecast. As a result, the enhanced approach adds little to the standard multiples model.

6. Conclusion

Here we propose an enhanced valuation model that combines elements of the standard market multiple and DCF approaches. The model uses the ICC calculated for a sample of comparable companies as an "enhanced" multiple which relates the value of a company to the entire forecast stream of future cash flows. This extends the standard multiples analysis which is based on only one year of financial performance. Unlike the DCF approach, which also uses the full sequence of cash flow forecasts, the enhanced approach does not require estimation of the cost of equity capital – a difficult and often controversial undertaking. Instead, the cost of equity capital is replaced by the enhanced multiple, derived from the comparable companies, which relates cash flow forecasts to value.

Our empirical tests reveal that, at least for our sample, the enhanced approach is more accurate than either of the two standard approaches but not to the same extent. We find that the enhanced approach performs dramatically better than the DCF approach, but only slightly better than the standard multiples approach. An explanation for this finding is that both the enhanced model and the multiples model allow for changes in the risk premiums (which are impounded in the multiples), whereas the DCF model based on a cost of capital estimated from historical data holds risk premiums effectively fixed over time. During our sample period, when the evidence suggests there were significant changes in risk premiums, it is not surprising that the DCF model performs poorly.

Finally, we note that like the market multiples approach, the enhanced approach does have the limitation that it requires the identification of comparable companies. Because it is based on comparable companies, it cannot be used to estimate intrinsic value, as opposed to implied stock market value. Nonetheless, the results reported here suggest that the enhanced approach provides an important addition to an appraiser's toolkit. In addition, it should be an interesting topic for future research.

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