THE DISCOUNTED CASH FLOW MODEL

USING NEW MODELING TO
TEST REASONABLENESS

by
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Introduction: The Discounted Cash Flow Model, or DCF, resides at the very "heart of valuation."[3] The model permits understanding about value from the most important perspective of all – the likelihood and amount of receiving future financial benefits. DCF is widely used and accepted: by appraisers, securities analysts, deal makers, economists, companies, and courts. Yet that very wide acceptance may have produced complacency in modeling and applications, failing to ask how the model may be empirically tested and improved.

The authors propose that different analysts using DCF can honestly arrive at significantly divergent company values, even when using the same set of client information. The variance stems from the many inputs and assumptions required for a discounted cash flow model and by the use of 'net free cash flow' as the economic benefit.

The authors believe that users should view the DCF income approach model within historical context as the Discounted Economic Income Method (DCEI), as discussed by Dr. Shannon Pratt,[4] and that researchers develop measurement methodologies to test the reasonableness of output. In this article, the authors introduce a computer model developed by Life Cycle Returns (LCRT). Although the LCRT platform was developed for use by portfolio managers for publicly traded securities, we will demonstrate that it has potential for use with privately held companies. Testing conventional valuation represents one such application.

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[3] Pratt, Shannon, Reilly, Robert, Schweihs, *Valuing a Business* (New York: McGraw-Hill, 2000), p. 152.

[4] Pratt, Shannon, *Business Valuation Body of Knowledge, Exam Review and Professional Reference* (New York: John Wiley & Sons, 1998), p. 82.

DCEI becomes important because, while appraisers focus on net free cash flow,[5] other economic benefits exist. Pratt points out, "…economic income could mean…gross revenues, gross profits, net operating profits, net income before tax, net income after tax, operating cash flow, net cash flow before tax, net cash flow after tax, or net cash flow available for distribution to owners…" among other potential measures of economic income.[6]

Aswath Damodaran[7], another valuation expert, notes, "…this approach is easiest to use for assets (firms) whose cash flows are currently positive and can be estimated with reliability for future periods, and where a proxy for risk that can be used to obtain discount rates is available. The further we get from this idealized setting, the more difficult discounted cash flow valuation becomes."[8] Pratt makes the same observation, stating, "Such economic income projections may be difficult to make – and even more difficult to get two or more parties with different investment perspectives and transaction expectations to agree on."[9]

Choice of Models: Which economic measure to use has become the focus of another debate: whether to use an equity model or an invested capital model. The equity model obtains a value for equity by forecasting estimated cash returns to equity as theoretical dividends. The invested capital model incorporates all the firm's capital to develop a firm value by estimating cash returns available to both equity and debt holders.

For an equity model, the appraiser assumes that the capital structure may vary in the near or intermediate term or that growth or margins may change. For such models the analyst explicitly builds the changes into discrete periodic projections (usually annual). The models display the changes until the business unit reaches expected stability for capital structure and growth.

Besides the multi-period model, the Capitalization Method[10] represents another model using discounted future economic benefits. Analysts employ the Capitalization Model when a company is stable and they expect it to grow revenue, earnings, and cash flow at a

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[5] The authors have used net free cash flow in this article rather than free cash flow, a term first set forth by Modigliani and Miller in the Journal *of Business* in October 1961. Net Free Cash Flow is a term and method more familiar to valuation professionals.

[6] Pratt, Reilly, Schweihs, p. 153.

[7] Aswath Damodaran: Professor of Finance and David Margolis Teaching Fellow, Stern School of Business, New York University. MBA and Ph.D degrees from University of California at Los Angeles. Research in valuation, portfolio management, and applied corporate finance. Author of *Corporate Finance: Theory and Practice.*

[8] Damodaran, Aswath, *Investment Valuation, Second Edition* (New York, John Wiley & Sons, 2002), p. 18.

[9] Pratt, Reilly, Schweih, p. 154.

[10] Pratt, p. 82.

consistent rate. The Gordon Growth Model[11] represents one commonly accepted Capitalization Model, a single-state discounted economic income method.[12]

Theoretically, both the capitalization and the multi period discount models should return the same value. Often, however, obtaining a reliable estimate of long term growth becomes difficult, if short to intermediate term growth will vary considerably from the long term. Both the multi-period model and the single period model use similar information, except the capitalization method forecasts a single rate of long term growth rather than varying the growth rate or capital structure from year to year.

Appraisers have mostly adopted the use of net free cash flow discounted to net present value as their preferred economic benefit to model companies and account for returns. This model has some faults that are well publicized. The greatest risk is the reliance on *subjective* analyst input of the many critical variables required.

The analyst using a discounted cash flow method examines past company performance, but depends on personal evaluation of that past performance, coupled with management's projections and industry forecasts, to predict a likely future. Small changes made by the analyst in certain underlying assumptions may alter a value estimate significantly.

Analysts use many assumptions for projected future economic performance, which, taken together, may result in values that depart significantly from reality. Inputs include: sales growth rate, cost of goods sold, selling and administration expense, desirable financial leverage, cost of debt, collateral values and source of lending, inventory investment, accounts receivable and payable management, and many other factors. Although analysts acquire information on a firm's past performance and assess industry and economic conditions, ultimately the analyst inputs remain subjective, relying on the analysts' knowledge, skill, and experience.

It's not uncommon for analysts to input 20 or more assumptions into DCF models, all based on judgment. Small changes in assumptions can result in large changes in determined value. Assumptions for the income statements and balance sheets produce estimated net free cash flows in projected cash flow statements.

The projected cash flow statements display how the assumptions produce cash for the subject company during the year and how that cash is expected to be used. The cash

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[11] A model for determining the intrinsic value of a stock, based on a future series of dividends that grow at a constant rate. Given a dividend per share that is payable in one year, and the assumption that the dividend grows at a constant rate forever (in perpetuity). *Investopedia.com*, 2000. J. B. Williams first developed these formulas in *The Theory of Investment Value* (Harvard University Press, 1938). M.J. Gordon and Shapiro rediscovered them in "Capital Equipment Analysis: The Required Rate of Profit," *Management Science*, October, 1956, pp. 102-110.

[12] Pratt, Shannon, *Cost of Capital* (New York, John Wiley, 1998), p. 118. "All DCF cost of equity models are rooted in the Gordon Growth Model…"

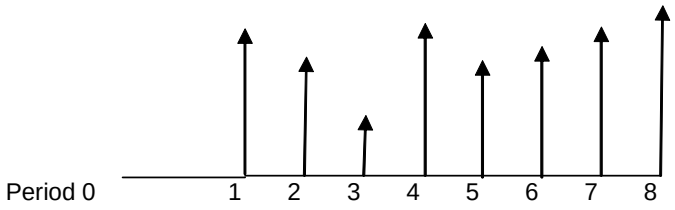
remaining after reinvestment to support future needs for growth and normal operations is called "net free cash flow." It represents the discretionary cash the business creates.

The following table illustrates an example of the elements included in the concept of net free cash flow:

Net Income	**204,104**
+ Depreciation	**+22,772**
+ Working Capital Decreases	**+51,587**
- Capital Expenditures	**-34,809**
= Net Free Cash Flow	**243,654**

When net free cash flow is analyzed in discrete periods, usually years, it is discounted to present value by applying a discount rate. The discount rate incorporates the risk free cost of capital, the amount of risk associated with holding securities generally, the extent of additional risk associated with the kind of investment in the specific company, and the further risk associated with unique characteristics of a particular subject investment. If the net free cash flow is used only as a single state input and then capitalized by applying a divisor to generate a value that represents net cash flows into perpetuity, then the divisor is the discount rate less a constant growth rate. (The Gordon Growth Model) .

The diagram below illustrates forecasted cash flows for a multi period model:



The beginning point is 'Period 0'. Thereafter, each year is indicated, from 1 to 8. Accompanying each year there is an upward arrow depicting net cash flows or other economic benefit. For years five to eight, a single period capitalization model could be used for a traditional DCF as the rate of increase appears to be consistent. The irregular increases in height of the arrows for periods one to five suggests that a multi period model would be required for a traditional DCF analysis for these periods. Thus the analyst would likely use a DCF model for periods one to five and then a single period model thereafter to determine the net present value of expected future cash flows for traditional DCF valuation work.

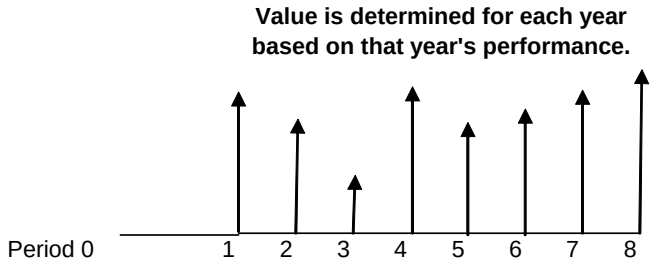
The model demonstrates when analysts use multi period models for company evaluation rather than single period models, and how they blend the two. The variation in net free cash flows in early years complicates identifying a single long term growth rate.

The LCRT model, however, uses a single period capitalization model for each period, regardless of cash flow irregularity, instead of using multiple periods. Later this paper defines the concept of cash economic return and discusses important adjustments made to

both growth rate and net free cash flow so that analysts can employ the single period instead of a multi period model. Whereas a multi period model is used until stability is achieved, LCRT substitutes a procedure called "fade" to obtain stable or normalized structure and cash flow over time.

Fade represents the single most important tool that permits the analyst to utilize a single period model rather than a multi period forecasting model. It also becomes one of the critical devices to reduce subjective analyst input. As a mathematical measure of regression toward the mean, fade adjusts abnormal returns, positive or negative, to a normalized return over time. *Of great research significance, employing a single period model enables extensive empirical testing of several models applied to thousands of companies over a decade.*

LCRT calculates a capitalized value (an "intrinsic value") for each period rather than aggregating a single value from the total of all periods. LCRT uses the same process for individual historical years which enables the Research Platform to evaluate the effectiveness of the model for any year in the past and suggest a confidence measure for present and future values.



The research process assumes that if past intrinsic values correlate closely to past actual prices, the same model should produce estimated future values with a similar high level of confidence.

Testing the sensitivity of the valuations to varying the inputs represents one tool sometimes used to assess the amount of risk in the analyst inputs.[13] By identifying which variable inputs cause the largest change in outcome with the smallest change in input, the analyst identifies critical factors that warrant closer scrutiny. Although useful, the authors believe that few analysts ever test for sensitivity, and even those who do seldom use the information to provide added meaning to the valuation.

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[13] Wikipedia at http://www.wikipedia.com: Sensitivity analysis is the study of how the variation in the output of a model (numerical or otherwise) can be apportioned, qualitatively or quantitatively, to different sources of variation. The technique offers a way to characterize the uncertainty embedded in a model.

Baseline Model: The authors suggest a baseline value model as one way to evaluate DCF output for reasonableness. A baseline model uses historical financial information to determine a subject company value with minimal analyst intervention.

Ideally a baseline model uses financial inputs from a subject firm and integrates those inputs with industry peer and historical subject company performance output. Preferably, analyst intervention, if any, becomes limited to estimated future earnings, sales, and capital turnover for the industry or subject firm.

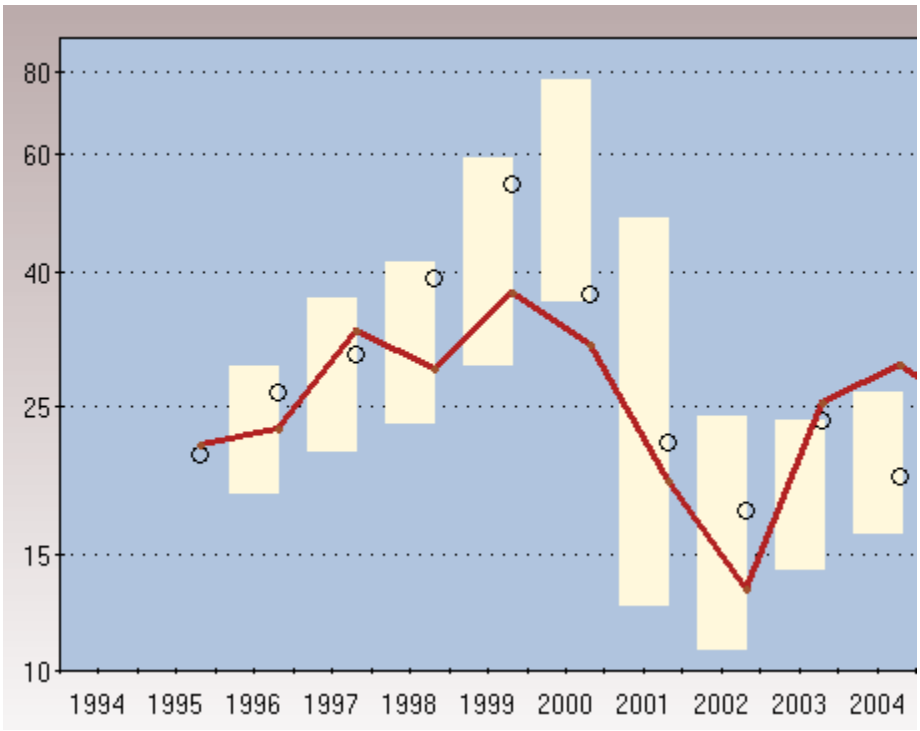
The rapid growth in personal computer technology and financial statement databases of public companies in the past decade permits analysts to achieve such a model. While the cost of retrieving both historical and current financial information of subject company peers remains high, the overhead of empirically researching several models significantly reduces the individual usage cost if allocated over multiple applications and users.

Ideally a model for such application offers both historical evaluations as well as future estimates so that an analyst can judge the reliability of the historical outcomes and thus establish a measure of confidence for projected values. Importantly, the same valuation criteria[14] apply to the company's projected returns and value as the analyst used to obtain historical returns and value. In a public trading market, estimated intrinsic values compare directly to actual prices to establish the base line for valuation of forecasts.

Previously the authors discussed the practical difficulty of constructing models if those models required reconstructing periodic forecasts for a DCF. However, we noted that analysts may use single period capitalization models to simplify multi period DCFs, subject to certain fade adjustments to account for the interim period to reach stability.

[14] Or model structure.

Using this valuation process, the fade capitalization methodology applies to each historical and each future year to produce a unique value for any year included in the analysis. Applying the fade capitalization model produces single point values each year. In the graph below, the wide, white bars depict the trading range of a common stock during the fiscal year and the small hollow circles represent the closing price at fiscal year plus three months. The solid red line connects single period estimates produced by the valuation model.



The world of publicly traded common stocks enables analysts to benefit from knowing with certainty how markets valued the stocks in prior periods. For public companies, the analyst compares the output of the model with the actual price(s) reported for the common stock during the historical period.

The preceeding chart includes the high / low trading range of actual prices during the company's fiscal year (the long white bars) in contrast to a line produced by connecting the single point estimated intrinsic values. The chart offers a vivid visual of how the model intrinsic values (the red solid line) tracks the actual pricing (The long white bars and small hollow circles).[15]

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[15] Robert Shiller in "Do Stock Prices Move Too Much to be Justified by Subsequent Changes in Dividends" (American Economic Review, Vol. 71, No. 3 (June 1981), pp. 421-436), compares prices for the market to an intrinsic value derived from a dividend discount model. He observes that prices are much more volatile than the intrinsic values, as the reader may discern from the 'Value Chart' for this individual firm. Behavioral Finance hypotheses and technical analysis suggests investor psychological herd behavior

Not only do graphs provide visual displays of tracking correlation, the data provides a statistical confidence measure. Signed and absolute tracking errors measure the "goodness of fit" of the model to actual stock prices. The example below illustrates the precise calculation. Each year the % difference and % absolute difference columns calculate the differences between the price at Fiscal Year plus three months and intrinsic value. The three months reflects the disclosure lag for reporting to the Securities and Exchange Commission (SEC) and prevents 'look-ahead' bias in the measurements. Taking the 10^{th} root of the product of 1 + the % differences for each year produces the 8.49% signed and 20.01% absolute tracking errors.

Year	Price @ Fiscal Year + 3 Months	Intrinsic Value	1 + % Difference	1 + Absolute % Difference
1995	21.19	21.89	0.97	1.03
1996	26.31	23.27	1.13	1.13
1997	30.06	32.53	0.92	1.08
1998	39.19	28.61	1.37	1.37
1999	54.13	37.26	1.45	1.45
2000	36.85	31.09	1.19	1.19
2001	22.11	19.37	1.14	1.14
2002	17.41	13.34	1.30	1.30
2003	23.79	25.35	0.94	1.06
2004	19.59	28.93	0.68	1.32
		Product	2.26	6.20
Tracking Errors (10th Root - 1) * 100%			8.49	20.01
			Signed Tracking Error	Absolute Tracking Error

A method now exists to empirically and mathematically test the accuracy of a model. The analyst becomes able to determine a baseline with two associated measures of accuracy. The lower the tracking errors are, the more accurate the model becomes.

The authors believe that using a single period capitalization method becomes reliable in place of the multi period model so long as certain critical changes occur in the model. The well-regarded *Value Line Investment Survey*[16] uses capitalization models in place of

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causes stock prices to oscillate around intrinsic values, both at the market level and at the firm level.

[16] *Value Line* publishes more than a dozen print and electronic products serving more than half-a-million investors for timely information on stocks, mutual funds, special situations, options and convertibles. Investors and analysts best know the company for *The Value Line Investment Survey*, which, according to the company, is the most widely used independent investment service in the world. *The Survey* is a comprehensive source of investment information and advice on approximately 1,700 stocks, more than 90

multi period models. Most analysts familiar with that advisory *Survey* are comfortable with the methodology.

Value Line began employing a capitalization model of cash flow (net income + depreciation) in the 1930's to display its estimate of value for a company. In 1984, one of the authors of this paper, Rawley Thomas, suggested to Chuck Callard that he use a similar display concept to show the tracking of the Callard Madden Associates[17] (CMA) valuation model results. Subsequently, HOLT[18] Planning, HOLT Value, The Boston Consulting Group (BCG), Applied Financial Group (AFG), and CSFB HOLT illustrated each of their models with value charts.[19]

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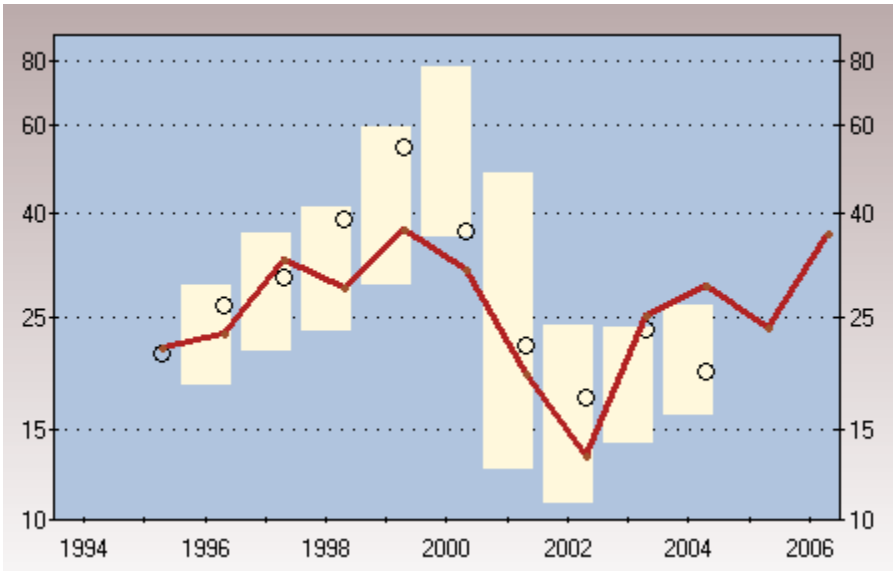
industries, the stock market, and the economy. See http://www.ValueLine.com for further information.

[17] CMA became Callard Research which became Ativo. John Lafferty of Lafferty Associates also learned from Chuck Callard.

[18] In 1985, Bob Hendricks, Eric Olsen, Marvin Lipson and Rawley Thomas co-founded HOLT. The last names of the four principals created the H-O-L-T name. In 2001, Thomas at LCRT began employing Value Charts to display results for multiple models.

[19] Application of these valuation models include stock investment decisions and business unit strategic planning to assure stockholder wealth creation. LCRT back tests suggest excess investment returns occur as price migrates toward intrinsic value over several quarters.

The following value chart, obtained from an LCRT screening, illustrates the inclusion of earnings per share (EPS) estimates to one of the valuation models (assuming constant non-earnings margin[20] and capital turnover). Visually, a strong likeness exists to *Value Investment Survey's* single chart data display. Note that the decrease in EPS for the current 2005 year before rebounding in 2006 translates to a decline in intrinsic value for 2005.[21]



In the past 20 years, Joel Stern and Bennett Stewart created EVA® (Economic Value Added)[22] to shift the focus from valuing the whole to determining if achieved returns on company capital exceed the cost of capital. Stern-Stewart call these differences excess company returns. Academics call them residual income. Excess company returns as a management tool has dominated finance theory discussion since Stern-Stewart introduced them.[23] EVA and similar models assert any return that is less than the cost of capital destroys wealth, while any return greater than cost of capital creates wealth.[24] LCRT

[20] Non-Earnings margin is the part of Cash Economic Return as a % of sales not represented by earnings. Technically, it equals gross cash flow less earnings or depreciation and amortization plus inflation adjustments as a % to sales. Please refer to later discussion on Cash Economic Return.

[21] Thanks to Tom Copeland for suggesting that this methodology effectively separates the migration of price toward intrinsic value based purely on history from the migration of price toward analysts' forecasts.

[22] Stewart, G. Bennett, *Quest for Value* (United States of America, HarperCollins Publishers, 1999). EVA® is a registered trademark of Stern Stewart.

[23] Slee, Robert T., *Private Capital Markets* (New York, John Wiley & Sons, 2004), p. 112.

[24] Slee actually discusses differing value worlds and as such is not directly applicable to the authors' theory.

uses a similar concept[25] and examines the differences between the model's intrinsic values compared to actual pricing. In this usage, the % difference represents a modeling error to establish a measure of model reliance.

Up to now, the discussion illustrated a model suitable for *publicly traded common stocks* that is capable of rendering a confidence measure for assessing the validity of projected pricing. The authors believe that similar valuation models with their measures of reliability apply to privately-held firms using comparable publicly traded common stocks as a proxy for the private firm. The information obtained from the public companies produce 'benchmarks' applicable to private companies. Business appraisers find this methodology familiar as it is used when applying the market approach for valuation.

Application to Private Firms: The remaining discussion includes charts and other outputs generated by a proprietary model developed by Life Cycle Returns (LCRT) on its Research Platform. The LCRT model provides a way for using publicly traded common stock information to determine a value and confidence level for a privately-held firm. The private common stock model uses mostly the same economic factors as previously discussed: development of a fade capitalization rate derived from the public sector and applied to subject company financials.

Using pricing and economic information from public companies is common practice in valuing private companies. Of the three approaches appraisers use to determine value (the income approach, the market approach, and the asset-based approach), the market approach is most exemplary. Internal Revenue Service (IRS) Ruling 59-60[26] and many accounting and auditor requirements (such as Statement of Financial Accounting Standards 141 and 142) favor the market approach, especially the use of publicly traded companies. Analysts favor public companies, because they disclose readily available information for trading, financial performance and condition, and other non financial reporting statistics.

Selecting and applying public company information for private company valuation is accepted practice.

The LCRT model differs from appraisers' models in the method used for selecting comparable public companies. LCRT, by default, chooses public companies based on economics alone.[27] [28] The LCRT selections are similar to the valuation subject company

[25] But with important differences related to the treatment of depreciation, accumulated depreciation and inflation which LCRT suggests translate to improved empirical model accuracy.

[26] Revenue Ruling 59-60, 1959-1,C.B. 237.

[27] RR 59-60, Section 2013(b) does not detail how to select guideline public companies, but, in addition to industry, stipulates economic comparability. The authors believe that while most appraisers fulfill the industry screen, but pay less attention to economic comparability. LCRT's screen reverses that process, viz., the economic screen becomes the most important.

with respect to revenues, assets, growth, return, etc. However, the selection method differs from the conventional approach of using the industry first[29] as a screen, and then determining if the companies selected share reasonably similar economics. In practice comparability in economics often only screens for a band of revenues, earnings, or total assets, with no attention given to other economic factors.[30]

To this point, the baseline model substitutes a fade capitalization method for the periodic discounted cash flow method. The process also screens selected publicly held companies to obtain historical economic returns and pricing. The developed pricing – intrinsic model applies to historical periods and to the present. Empirical evidence[31] suggests that the concept of using a capitalization method in place of a multi period method may become acceptable, provided the analyst makes certain fade adjustments to the firm's cash rates of return on its operating assets.

The values produced by the model for past years compare to historical actual stock prices to obtain a confidence measure – the tracking error. Assuming the attainment of a sufficiently high reliability measure, analysts employ the value model to estimate present and expected future values for the private firm, by using the same formula applied to the public company pool, along with a prescribed confidence level. Of course, the usual discounts for marketability and liquidity apply.

As a final step, the analyst compares the findings produced by the baseline model for the private company to her findings using the conventional multi period discount model or other approaches. For significant value differences, the analyst searches for an explanation, a traditional part of the reconciliation process.[32]

The proposed valuation model and associated empirical testing Research Platform offers a totally different method for valuing a private firm and a reasonableness check on

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[28] As Yuji Ijiri observes ("Recovery Rate and Cash Flow Accounting", *Financial Executive,* March 1980, pp. 54-60), investors should not care to what industry the firm belongs or what type of assets it purchases, only how well the firm employs the investors' cash investment to generate cash returns for the investors' benefit.

[29] Pratt, Shannon, *The Market Approach to Valuing Businesses* (John Wiley & Sons, New York, 2001), p. 51.

[30] Economic comparables differ from traditional comparables, because economic comparables divide the universe into firms with similar cash economic returns, size, asset life, leverage characteristics, and asset mix between depreciating and non-depreciating assets. Searching the data base for 10 years may produce 50 to 200 economic comparables and provide a range of values based on the % under (over) valuation of all the firms selected. The LCRT model derives unbiased intrinsic values with 50% of the firms under valued and 50% of the firms over valued.

[31] LCRT has conducted many tests, the contents of which are available on request.

[32] Pratt, Shannon, *The Lawyer's Business Valuation Handbook, Understanding Financial Statements, Appraisal Reports, and Expert Testimony* (American Bar Association, Chicago, Illinois, 2000), p. 228-236.

findings. In the early years of business valuation, analysts frequently applied a *justification for purchase test.*[33] The analyst applied this test after she completed the reconciliation, but before accepting the final opinion, to assure that the pricing value was reasonable. The test posed a theoretical business purchase; setting forth normally accepted financing terms.

Contemporary literature seldom mentions the justification of purchase price test, but the test remains valid nonetheless. In some courts, the same question may arise, although by a different name.[34] The court or any other user wants to know if the valuation findings are reasonable. Even in cases when parties agree to be bound by an appraiser's conclusion, there can be exceptions if the findings are not reasonable.[35]

In many circumstances, the authors believe that analysts can run an LCRT valuation as a final test to confirm empirical validation of assumptions.

Choosing a Model: When choosing different approaches and methods for valuing a firm, the analyst should select methods that are true alternatives and not simply different models using essentially the same inputs and mathematics with only cosmetic changes to procedures.[36]

When different models produce nearly the same value, the analyst may conclude the value reflects a high confidence level, while, in fact, the autocorrelation of separate models may disguise that only one method was really used, but confused as two. For example, if the DCF and a capitalization model produce the same value, the similar values may only stem from a non varying long term growth rate. In that case, the models are essentially the same and auto correlate, but do not justify added confidence because they agree in findings.

The LCRT model employs different procedural methods compared to those used by contemporary valuation practitioners. Although parts of LCRT's model appear the same as conventional valuation practice for capitalization models, the LCRT Platform distinctly differs in several important ways. The LCRT model uses most of the same raw data, but implements some different financial information for a subject company. The following points enumerate some of those differences.

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[33] Miles, Raymond, *Basic Business Appraisal* (John Wiley & Sons, New York, 1984), p. 294, 272-277.

[34] *Advanced Communication Design, Inc. v. Follett,* 615 N.W.2d 285, 293 (Minn. 2000). This case, in which Schostag was one of the appraisers, established a bright-line rule requiring proof that the payout in a shareholder dispute would not harm the firm.

[35] *Robinson v. Robinson,* WL 237200 (Ohio Ct. App. 1990) and *In re Marriage of Griepp,* 381 NW, 2d 865 (Minn. Ct. App. 1986).

[36] Pratt, Reilly, Schweih, pp. 437-448. Valuation Synthesis and Conclusion.

The model:

- Provides for fixed asset changes, both with respect to reinvestment as well as inflation (most present models do not explicitly measure the impact of inflation on economic performance),
- Uses a proprietary growth rate (LCRT examines both revenue for forecasts and historical asset growth rates from retained cash available for reinvestment),
- Obtains the discount rate from the analyses of comparable public companies used within the initial discovery as opposed to applying a measure calculated by an external source such as Ibbotson.[37] This means that the valuation results from fading Cash Economic Returns differ significantly from conventional net free cash flows previously defined and most often relied on by appraisers.

Net Free Cash Flow vs. Cash Economic Return and Spot (Equity) Value: LCRT uses procedures for determining:

(1) The capitalized or intrinsic estimated value of a security each year, and

(2) The amount by which the actual price varies from the historic estimated intrinsic value each year. Please understand the following factors within the context of the LCRT model, as each factor retains subtle differences from similar terms in current use by appraisers. The following are only broad overviews. Later, the paper discusses the terms in more depth.

   a. Cash Economic Return
   b. Value Multiplier (LCRT replaces the traditional 1 ÷ (discount rate – growth rate factor by an explicit 50 year forecast of constant dollar net free cash flows)
   c. Fade
   d. Perpetuity Assumption
   e. Spot Intrinsic Value
   f. Price Difference and % Over / Under intrinsic value

(3) The authors assume appraisers understand Net Free Cash Flow. It is the cash inflow left over after using cash for changes in working capital and capital expenditures. It also represents the theoretical dividend paying capacity of the firm.

(4) LCRT makes important adjustments to the conventional measure of net free cash flow. Instead of employing conventional sales growth rates, margins, and capital turns to drive net free cash flow, LCRT uses fading growth rates to drive asset levels and fading Cash Economic Returns to drive gross cash flows (net income + depreciation).

[37] Ibbotson Associates have provided discount rate information for analysts (among other products and services) since 1977. See http://www.Ibbotson.com.

(5) The equation, 1 ÷ (discount rate – growth rate), is part of the Gordon Growth Model and forms the basis for most income approach models. Appraisers are familiar with how to use this model to obtain the present value from a capitalization method. LCRT's model differs from the conventional capitalization model in two important respects:

a. The discount rate derives from the universe of public stocks, and the same discount rate applies to all individual securities. LCRT does not specifically build up the discount rate or adjust it for unique risk in the same manner in use by most appraisers today. LCRT's fade and other adjustments place traditional risk into certainty equivalent cash flow forecasts built into the model.

b. The appraiser designates the growth rate in the conventional model as an input. She may vary the growth rate short to intermediate term, but normalizes it into a single rate for the terminal value reflecting net free cash flows projected into perpetuity. The time at terminal value represents a stabilized state by the model which is sustainable thereafter. In contrast, the LCRT model develops growth rates from historical information for both revenue forecasts and assets from cash available for reinvestment.

(6) The model 'fades' the starting growth rates over time to long term growth that mirrors the overall real growth rate in GDP in the economy. The degree of fade or change from a subject company's present state to its normalized long term state relates to the mathematics within the model in contrast to subjective analyst inputs in present DCF models. Growth starts at the sustainable real growth rate of the company derived after paying dividends and replacing plant investments. The growth rates fade toward the 3% economy real growth rate, according to a proprietary function of company size,[38] representing the empirically validated market expectations of investors.

(7) Both Discounted Flow Models and Capitalization Models now used by appraisers assume cash flows into perpetuity. LCRT uses a 50-year assumption rather than perpetuity. The finite assumption rather than the infinite one relies on an assumption that no company exists forever. Few companies in existence 100 years ago remain today, regardless of the theoretical construct.

(8) The "spot intrinsic value" represents the intrinsic value based on *that* year's specific cash economic return. The model offers a spot intrinsic value for up to ten years in the past and into the future using the single period procedure.

[38] The same function based on company asset size applies to all firms in the super sector industrial universe. Institutions and individuals signing the non-disclosure license agreement may view the complete audit trails of all calculations within the LCRT Platform for all companies for all years in Excel and Visual Basic.

(9) Spot Intrinsic Value - Stock Price = Price Difference. Price Difference ÷ Spot Intrinsic Value = % Under (Over) Value. Understanding % Under or Over Valuation of historical intrinsic values to actual price assists in assessing model reliability.

The series of spot intrinsic values over time creates an empirical ***baseline.*** Percent differences between spot intrinsic values and actual prices assist in determining the ***confidence level*** of the model. Tracking errors, previously illustrated, measure this confidence level.

Example of Use for Baseline: To illustrate application of the foregoing baseline principle, please consider a business broker who daily faces value decisions on many businesses. She may apply a simple multiple as a "rule of thumb" to estimate value quickly. Eight times EBITDA[39] represents one such multiple or ratio to estimate value rapidly.

To assist the business broker in verifying the reliability of the 8 X EBITDA multiple tool, the researcher may apply the broker's formula to a large pool of similar public stocks with reported historical price levels to determine if the formula successfully correlates with meaningful confidence in those instances. Please recall the earlier illustration of tracking errors to measure the reliability of intrinsic value models to actual stock prices.

If the differences in the values are small, the broker may use that multiple with some confidence, while recognizing explicit limitations based on the sample selected. If the differences are large, the broker must consider another measure. The researcher now possesses an empirical tool to measure the reliability of the rule of thumb for the broker.[40]

Value Factors More Fully Defined: Traditional free cash flow valuations may employ sales growth rates, capital turns, and margins as key value drivers. LCRT's model employs different primary drivers: cash economic return and a sustainable growth rate. LCRT transforms the cash economic return and sustainable growth rates into *certainty equivalent market expected constant dollar net cash flows*. The following outline describes the process, discusses the drivers, and illustrates the calculations:

Cash Economic Return: Because excess returns on investment are so important to an accurate understanding of valuation issues, analysts exercise great care using the balance sheet as reported for valuation. Reported balance sheets with historical carried costs contain significant distortions caused by depreciation and amortization decisions as well

[39] Earnings Before Taxes, Interest, Depreciation, and Amortization.

[40] During 2005 LCRT introduced a *ValuFocus* product for users to obtain rapid, albeit limited confidence, calculations on the 8 X EBITDA rule of thumb, as well as other models.

as inflation effects.[41] In the LCRT model, the authors seek a cash on cash return by adjusting the balance sheet to current dollars. This does not imply using a replacement cost analysis but rather restating the cost of past purchased fixed asset investment to reflect inflation since that investment.

LCRT uses Cash Economic Returns and gross asset growth rates for value drivers. These value drivers replace commonly used net free cash flow and sales growth rate for traditional valuation models. Net free cash flow improperly adjusted for distortions of income, such as depreciable asset changes, may produce erroneous balance sheet values.

Some background on the Cash Economic Return proves helpful. Accounting academics have observed that annual accounting rates of return (ARR), return on equity (ROE), return on net assets (RONA), return on capital employed (ROCE), and return on assets (ROA) do not reflect the economic or internal rate of return (IRR) of either underlying projects or the business as a whole. In the 1970s and 1980s Ezra Solomon, Gerald Salamon, and Richard Brief, building on earlier work, wrote some of what are now considered classic articles on the problem of relating economic to accounting returns.[42]

The difference between accounting returns and economic returns, economists believe, relates to the pattern of cash flows within a project, the depreciation method, the growth rate of the projects, the project life, and inflation. Using all of these determinants makes solving the problem practically impossible. If we can make a single simplifying assumption that most assets produce constant output and follow a constant dollar level annuity, we can create an annual performance measure – gross cash flow return on gross assets with a finite life. This measure equals the economic or internal rate of return of all underlying projects.

Building on Bart Madden's work[43] on the model corporation during the 1970's and Yuji Ijiri's work[44] on the cash recovery rate, the Cash Economic Return minimizes cash and inflation distortions of traditional accounting measures and reflects the average internal rate of return of all the projects in place within the business. By translating cash flows from the income statement and balance sheet into units of the same constant dollar purchasing power, models become able to display a return on their investment in the

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[41] LCRT's back tests suggest excess returns and general economic performance migrate toward historical intrinsic spot values over time.

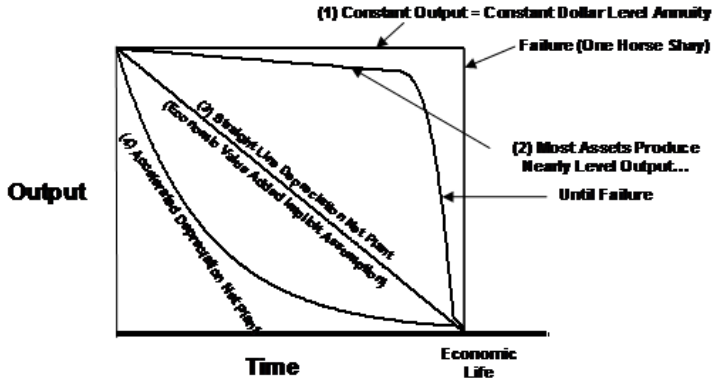
[42] See Richard P. Brief, ed., *Estimating the Economic Rate of Return from Accounting Data*, Garland, New York, 1986. See also, Richard P. Brief and Raef A. Lawson, "Approximate Error in Using Accounting Rates of Return to Estimate Economic Returns," *Journal of Business Finance & Accounting*, January, 1991, pp. 13-20 and "…A Correction," November 1991, pp. 915-916.

[43] Madden, Bartley J., *Cash Flow Return on Investment (CFROI) Valuation: A Total System Approach to Valuing the Firm*, Butterworth Heinemann, Oxford, 1999.

[44] Yuji Ijiri, "Recovery Rate and Cash Flow Accounting," Financial Executive, March 1980, pp. 54-60.

same purchasing units. Unlike most conventional measures, the authors believe that LCRT's assumption of nearly constant output by fixed assets produces more realistic returns than simplified measures of return on net assets.[45]

MOST ASSETS PRODUCE A NEARLY LEVEL USEFUL OUTPUT UNTIL FAILURE, INSTEAD OF THE STRAIGHT LINE OR THE DECLINING BALANCE CURVE REFLECTING DEPRECIATED PLANT



LCRT's model extends Madden's and Ijiri's work because it uses cash economic returns, growth in constant dollar gross assets, and replacements of depreciating assets to produce real net free cash flows.[46] The model applies an inflation measure based on the national deflation index obtained for the most recent reporting period.

Growth Rate: DCF and Capitalization Method growth rates traditionally tie to growth in revenues. Once models 'stabilize' for both capital structure and margin returns, growth in revenues corresponds with growth in profits and balance sheet classes. At this stabilization point under conventional DCF procedures, the multi period model stops and the capitalization model derives the remaining value into perpetuity. Traditional analysis tests the model's growth rate to determine whether sufficient cash flows exist to support expected growth each year and whether adequate means for borrowing exist, employing customary financed asset ratios. The expected annual growth in a DCF model varies, so the cash flow requirement also varies.

In contrast to the multi period model, LCRT derives a fade capitalization value for each year based on empirical research. The model redefines the economic benefit, which simultaneously affects reported balances for depreciable assets. LCRT evaluates the changes in both fixed assets and economic benefits with corresponding adjustments for

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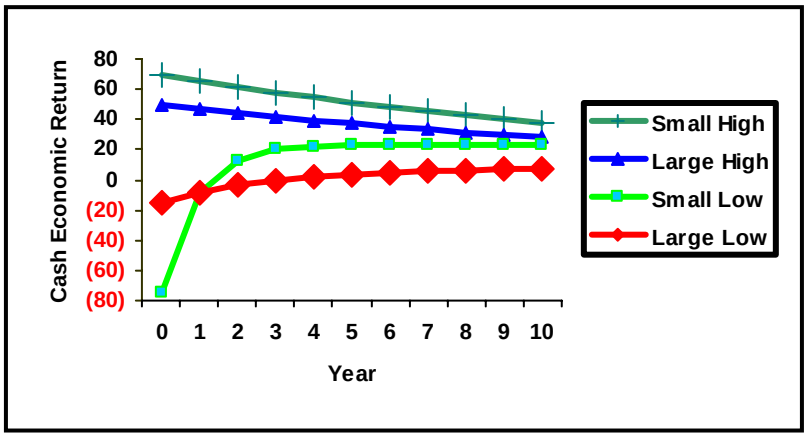
[45] For RONA to be comparable to the IRR, output must decline linearly with the increase in accumulated depreciation and inflation must be insignificant.

[46] See Richard P. Brief, *Estimating the Economic Return from Accounting Data,* Garland, New York, 1986, and Richard P. Brief and Raef A. Lawson, "Approximate Error in Using Accounting Rates of Return to Estimate Economic Returns", *Journal of Business Finance & Accounting,* January, 1991, pp. 13-20 and "…A Correction", November 1991, pp. 915-916.

inflation. The model integrates both the fading growth rate of gross assets and the fade rate of Cash Economic Returns to synthesize a change in constant dollar net free cash flows. This revised model mathematically determines a sustainable growth rate, similar to the traditional testing to assure that enough cash flow exists to fund expected growth. In the model's first year, the sustainable growth rate may be much higher or lower than the 'average' firm in the economy. Over time, the LCRT model assumes that the growth rate will stabilize at a rate comparable to the real 3% economy growth rate. This sustainable growth rate becomes a critical value driver in the LCRT model, contributing to the fade capitalization model's growth rate.

Fade: Empirical research confirms Cash Economic Return rates and the corresponding growth rate in assets regress over time toward the mean of all companies. The following diagram below shows how high returns fade down and low returns fade up. (Small versus large are measured on constant dollar gross investment.)[47] (LCRT research sets model parameters so 50% of firms are under valued and 50% are over valued in each region of the 5,500 universe of public industrial firms.)



Fade studies reveal the direction, rate of change, and duration before returns become average. Just as appraisers use multi period DCF models to shift a company model to a normalized state in both financial condition and income production over time before using a capitalized terminal value, LCRT's proprietary fade model adjusts the beginning capitalized returns to a normalized long term rate. *This fade pattern represents the single most important procedure to explain how a capitalized intrinsic value model can replace a multi period model.*

The numeric example following illustrates the exponential fade calculations used for the gross asset growth rate in the earlier company example. In 2004, the company employs constant dollar gross investment of $21.8 billion. Its sustainable growth rate begins at 5.67%. That beginning growth rate must now adjust over time to mirror the

[47] Small start-up firms form an exception to this pattern as the market prices those companies as though the average survivors will achieve superior returns above the average. Effectively, investors purchasing small start-ups are buying on option on superior economic performance on the IPO cash invested in operating assets.

growth of the economy to 3.0%. Fading the excess (beginning growth less long term economic growth) of the beginning 5.67 % growth rate to the 3.0% economy growth rate by 80% per year results in a 3.54% growth rate (3.54 =0.8 * (5.67 – 3.00) + 3.00) in 2005, one year later.

The calculated growth fade rate applies each year to the expected growth in assets to determine the required amount of new annual asset investment and the resultant total gross amount invested. Therefore, by applying the 3.54% asset growth rate in 2005, the model anticipates that the $21.77 billion 2004 investment will grow to $22.559 billion in 2005. 770 = 22,549 – 21,779 represents the change or new asset investment.

Year	Future Growth Rate	Constant Dollar Gross Investment
2004	5.67%	21.779
2005	3.54%	22.549
Increase		770

After regressing the growth rate in assets toward the 3% economy rate, the model next fades the cash economic return toward a normalized long term rate consistent with other companies in the economy. The following example illustrates the Cash Economic Return exponential fade calculation.

The company achieves a 20.17% Cash Economic Return in 2004, determined either by dividing gross cash flow less sinking fund depreciation by the gross investment or by calculating the IRR of gross cash flow against gross investment over the asset life with the release of non-depreciating assets. For positive gross cash flows, the two methods produce parallel answers. However, the IRR calculation fails with negative gross cash flows for start-ups and firms in financial distress. Therefore, the LCRT default case uses the ratio version, not the IRR version in order to have a calculation that works over the entire universe. LCRT's empirical studies indicate that this firm will fade to an approximate 12.57% rate of cash economic return. Not all firms fade to 12.57%. The Production LCRT model assumes that ***this*** company will fade to 12.57%, which is 35% of the difference between the starting CER and the 8% or so ending CER for the universe. In the Research Model all firms fade to about 8.00, but that fade-to varies from year to year. The actual calculation requires advanced empirical research to assure 50% of the firms are under valued and 50% are over valued. In the example company, a current cash return of 20.17% fades at a rate of 50% to 12.57%, resulting in 16.56% CER in 2005 (16.56 = 0.5 * (20.17 – 12.57) + 12.57. Applying the 16.56% CER to the 22,549 2005 investment produces 5,977 in gross cash flow (net income + depreciation).

Year	Constant Dollar Gross Investment	Cash Economic Return	Constant Dollar Gross Cash Flow
2004	21,779	20.17	6,462
2005	22,549	16.56	5,977

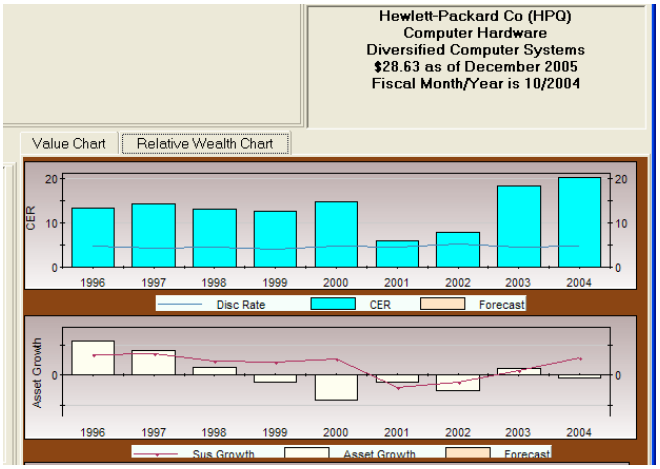
Subtracting replacement and growth investments results in 3,234 of net constant dollar cash flows:

Gross Cash Flows	+5,977
Replacement Investments	-1,973
Growth Investments (22,549 – 21,779)	- 770
Constant Dollar Net Free Cash Flow	+3,234

Discount Rate: In its most advanced valuation model, LCRT places all of the subject company risk into market expected certainty equivalent cash flows, while traditional DCF and Capitalization models use a build up method based on CAPM and adding unique subject company factors. The LCRT advanced model employs a single real cost of capital for discounting. The present value of cash flows for 50 years forms the 80,516 enterprise value. Adding non-operating cash, subtracting debt and dividing by shares outstanding produces a 28.93 spot intrinsic value per share:

Present Value of Cash Flows	+80,516
Cash - Debt	+ 3,687
Equity Intrinsic Value	+84,203
Number of Shares Outstanding	2,911
Equity Intrinsic Value Per Share	28.93

Example of Use: The key value drivers for the LCRT model are Cash Economic Return and gross asset growth rates. The following chart for Hewlett-Packard provides an application of the knowledge obtained from these drivers. The top panel on the chart compares the Cash Economic Return with the investor's real discount rate or cost of capital. The bottom or second panel compares the annual gross asset growth rates with the company's real sustainable growth rate.



Summary of Differences between Cash Economic Return (CER) and Traditional Accounting Return Measures: Five symmetrical adjustments to traditional financial statements produce the elements of the LCRT Cash Economic Return:

(A) Eliminate non-operating items,

(B) Translate to cash primarily by adding back depreciation & amortization and accumulated depreciation,

(C) Restate for inflation,

(D) Eliminate leverage, and

(E) Capitalize expenses.

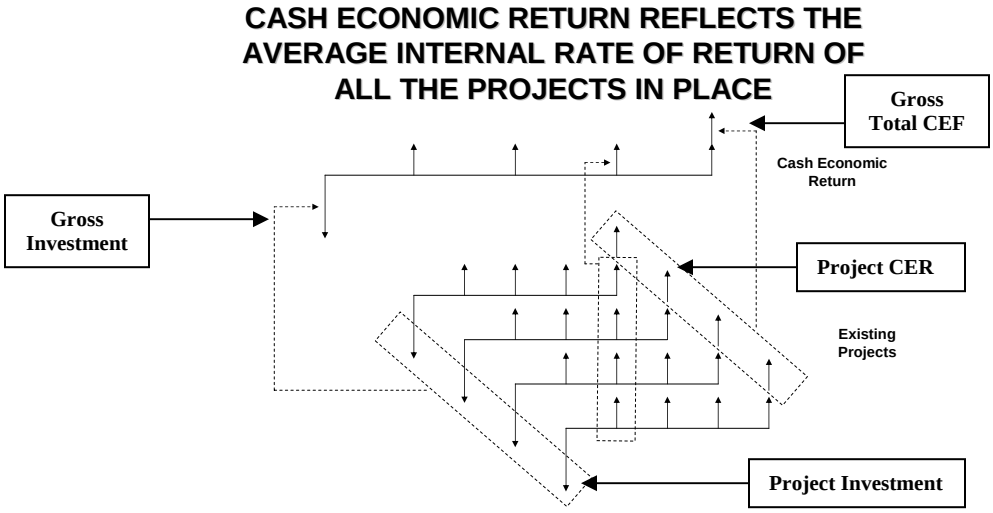
The following example explicitly illustrates the adjustments necessary to produce the numerator and denominator of the Cash Economic Return (CER) Calculation.

CASH ECONOMIC RETURN EXAMPLE: ACCOUNTING TO CASH

SUPERVALU– 2001 ($Millions)

		Income	$206	
	A: Eliminate Non-Operating	Special Extraordinary Items After Tax	33	
	Items	(-) Non-operating Expense After-Tax	(16)	
	B: Translate to Cash	Non-Cash Charges	333	
	C: Restate for Inflation	Inflation Gain on Non-Fixed Assets	14	
	D: Eliminate Leverage	After-Tax Interest (Debt and Operating Leases)	134	$781
$206		Rentals – Principal Payments	77	Current Dollar
Income	*E: Capitalize Expenses*	(-) Advertising and R & D After Tax	(0)	Gross Cash Flow
Assets		Total Assets	$5,825	Current Dollar
$5,825	*A: Eliminate Non-Operating*	(-) Non-Operating Assets	(137)	Investor Gross
	Items	(-) Purchase Goodwill	(1,531)	Cash
		Receivables Reserve	23	Investment
	B: Translate to Cash Invest.	LIFO Reserve	141	$5,704
		Accumulated Depreciation	1,580	
	C: Restate for Inflation	Inflation Adjustments to Land, Gross Plant and Deferred Taxes	249	
	D: Eliminate Leverage	Gross Leased Property from Operating Leases	1,202	
	E: Capitalize Expenses	Capitalized Advertising, R & D	0	
	F: Capital Owner Cash Invest.	(-) Operating Non-Interest Bearing Liabilities	(1,648)	

Since some readers are more familiar with economic returns on a project basis, a company's aggregate returns are obviously the sum of all of the individual projects in place within the firm. Graphically, the following diagram displays how the aggregate Cash Economic Return (CER) summarizes the average internal rate of return (IRR) of all the projects in place. In this example, the company invests in four projects.



The sum of the down arrows of the four Project Investments produces the gross investment or total cash invested in the firm. The total of the project cash flows or project CERs equal gross or total CER for the firm. The gross or total CER equals the internal rate of return (IRR) of all the projects in place, *irrespective of the growth rate of investment into the projects or a variable inflation rate. Because the IRR computes from gross investment rather than using depreciated or amortized values, this determination of return will substantially differ from the traditional accounting return measure calculated using net book value.* Generally, the accounting returns on depreciated book values are less than Cash Economic Returns for brand new assets and substantially greater for old assets as depreciated book value declines with increasing age.[48]

Allowances for Depreciation & Inflation: The gross cash economic return up to this point, however, provides an incomplete picture. It does not, for example, allow for inflation or depreciation. Where there is heavy analyst intervention, these factors may be computed. However, analysts seldom do the computations. LCRT calculates these factors mathematically, based on historical financial reporting.

There are two ways to think about providing for inflation. One way determines replacement cost for the assets. The other way believes that regardless of what replacement cost is, investors should be compensated for the purchasing power changes during the period of investment and thus should make an allowance for change in purchasing power. LCRT uses the second approach; it develops an allowance for

[48] Higher inflation rates increase the spread between accounting returns on historical depreciated cost over inflation adjusted Cash Economic Returns.

changes in purchasing power. It incorporates the United States government reported gross national product deflator for each year as constants in the model. Doing so provides a consistent view of invested dollars across investments.

Because the information supplied by companies includes original fixed asset cost or gross plant, annual depreciation, and accumulated depreciation, a computer module estimates the approximate past real growth rate of capital expenditures over the years. By examining a subject company's gross flow, less replacement expenditures and less dividends, the program divides the net amount by gross assets to obtain a long-term sustainable growth rate.

The resulting formula for the fade capitalization model follows:

Fade Intrinsic Value = Present Value of real net free cash flows produced from fading sustainable asset growth rates and applying fading Cash Economic Returns to those asset levels for 50 years and winding down the remaining assets thereafter.

The following example for SuperValu illustrates the application of these Cash Economic Return principles for a public company.

Calculation of the Cash Economic Return

The figure below displays the details of the Cash Economic Return for SuperValu in 2001.[49] The method transforms the $206 income and $5,825 assets into $781 of gross cash flow and $5,704 of gross cash investment, all expressed in the same units of investor purchasing power – 2001 current dollars.

CASH ECONOMIC RETURN EXAMPLE:
ACCOUNTING TO CASH
SUPERVALU– 2001 ($Millions)

		Income	$206	
	A: Eliminate Non-Operating	Special Extraordinary Items After Tax	33	
	Items	(-) Non-operating Expense After-Tax	(16)	
	B: Translate to Cash	Non-Cash Charges	333	
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	D: Eliminate Leverage	Gross Leased Property from Operating Leases	1,202	
	E: Capitalize Expenses	Capitalized Advertising, R & D	0	
	F: Capital Owner Cash Invest.	(-) Operating Non-Interest Bearing Liabilities	(1,648)	

[49] Source: Raw data from Standard & Poor's Compustat; Inflation adjustments from LifeCycle Returns, Inc.

- To income, LifeCycle Returns (LCRT) adds $33 in extraordinary items after tax and subtracts $16 in non-operating expenses. To assets, LCRT subtracts $137 of non-operating assets and $1,531 of purchase goodwill. These two adjustments focus the results on the operations.

- Non-cash charges of $333 in the numerator consist of depreciation, amortization, and changes to the allowance for doubtful accounts. In turn, adding back reserves for receivables, LIFO (inventory), and accumulated depreciation – $23, $141, and $1,580 respectively, returns to the original investor cash investment in the denominator assets.

- To reflect inflation and restate all historical dollars to 2001 dollars, LCRT computes a $14 gain on non-fixed assets in the numerator (GDP deflator change X non-fixed assets – payables and other non-debt liabilities for SuperValu exceed assets of receivables, operating cash, inventories, and other assets) and a $249 adjustment to land, gross plant, and deferred taxes to the denominator. Using the plant life and age enables approximate restatement of historical cost for plant to 2001 dollars without knowing internal company records.[50] When tested against internal company records from selected clients, the algorithm is accurate within 5-10%, unless capital expenditures have been extremely large in the last 1-2 years.

- Capitalizing $1,202 of operating leases in the denominator and adding back $134 of after-tax interest on debt and leases along with the $77 principal portion of rental payments to the numerator makes the measure independent of financial leverage.

- If SuperValu disclosed advertising and R&D, those elements would be capitalized in the denominator, while adding back the after-corporate-tax effect in the numerator.

- Lastly, LCRT subtracts $1,648 of non-interest bearing liabilities, in order to effectively reconcile to the cash investment made by all the equity holders, debt holders, and landlords.

The ratio of $781 gross cash flow to $5,704 is not yet a proper return measure, because it erroneously assumes the assets last forever. To reflect the finite life of depreciating assets, LCRT transforms the Cash Economic Return into a project, 9.09% internal rate of return (IRR) format, according to the following diagram.

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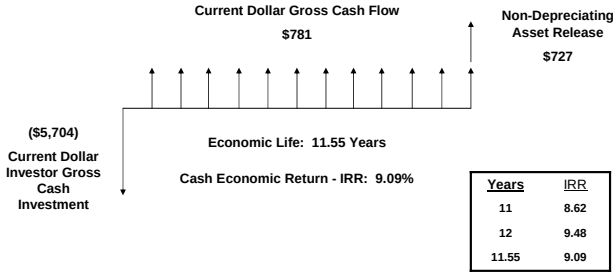
[50] Lewis, Thomas G., Daniel M. Stelter, Thomas Casata, Monika Reiter, *Steigerung des Unternehamenswertes (Total Value Management),* Verlag Moderne Industrie, 1994, pp. 244-247.

CASH ECONOMIC RETURN EXAMPLE:
CASH TO ECONOMICS

SUPERVALU– 2001 ($ MILLIONS)

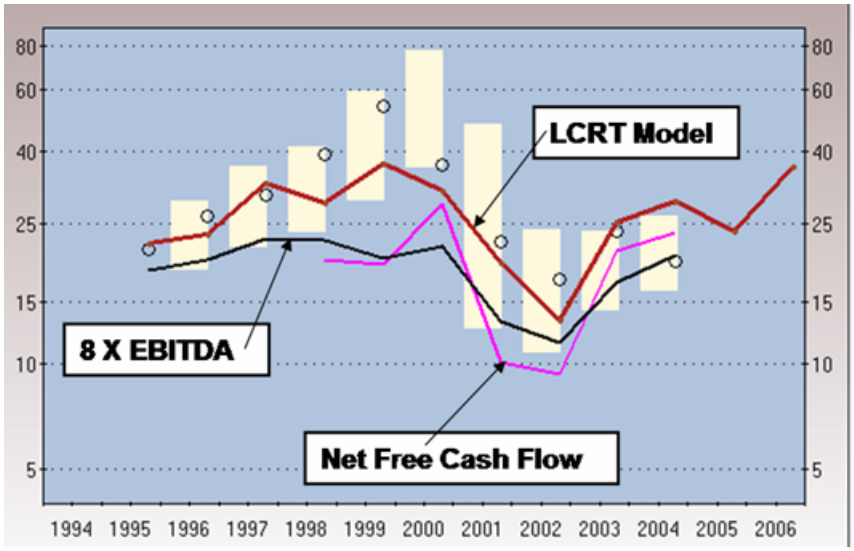


Years	IRR
11	8.62
12	9.48
11.55	9.09

The $5,704 down arrow reflects the current dollar investor gross cash investment expressed in 2001 dollars. The 11.55 ~ 12 up arrows of $781 reflect the current dollar annual gross cash flow available to all the investors and to the business for reinvestment. Life equals a weighted average of the operating leased asset life of 15 years and the plant life from gross plant / depreciation.

Of all the estimates, plant life merits the greatest scrutiny in client assignments to assure it reflects the economic life over which the assets produce cash flows until failure and to ensure the proper fixed asset inflation adjustment.

Empirical Evidence. This presentation would not be complete without comparing the empirical results of model accuracy for a traditional net free cash flow model, 8 X EBITDA, and LCRT's fade capitalization model based on Cash Economic Return, both for a single company and for the entire super sector universe. These comparisons illustrate an *empirical research process* for testing models and improving DCF valuations. The Value Chart following compares the annual spot intrinsic values of one company for the three capitalization models for each year.



The absolute tracking error for the net free cash flow model equals 37.4%. The Net Free Cash Flow Perpetuity model (from specifications from Dan Van Vleet while at Willamette) was based on growing free cash flow for "T" years and capitalizing the terminal year's free cash flow into perpetuity. Free cash flow = income after taxes + depreciation and amortization – non-operating items after tax – normalized capital expenditures – working capital additions. The terminal year's cash flow is capitalized by a median industry CAPM nominal discount rate less a nominal growth rate.

The absolute tracking error for the simplistic 8 X EBITDA multiple is 30.7%, somewhat lower and therefore more accurate than the Net Free Cash Flow Model.

The absolute tracking error for the LCRT fade capitalization model is 18.0%.

Of course, a single company[51] by no means represents a sufficient sample for empirical testing. The authors now turn to a more complete empirical test of model accuracy.

A way exists to summarize the data on 5,500 industrial firms in the super sector from 1994-2004.[52] This research method ranks the absolute differences between the stock's prices and intrinsic values for all company-years (about 30,000, since not all firms were in existence as public companies for all ten years). The model with the lowest tracking errors is the most accurate.

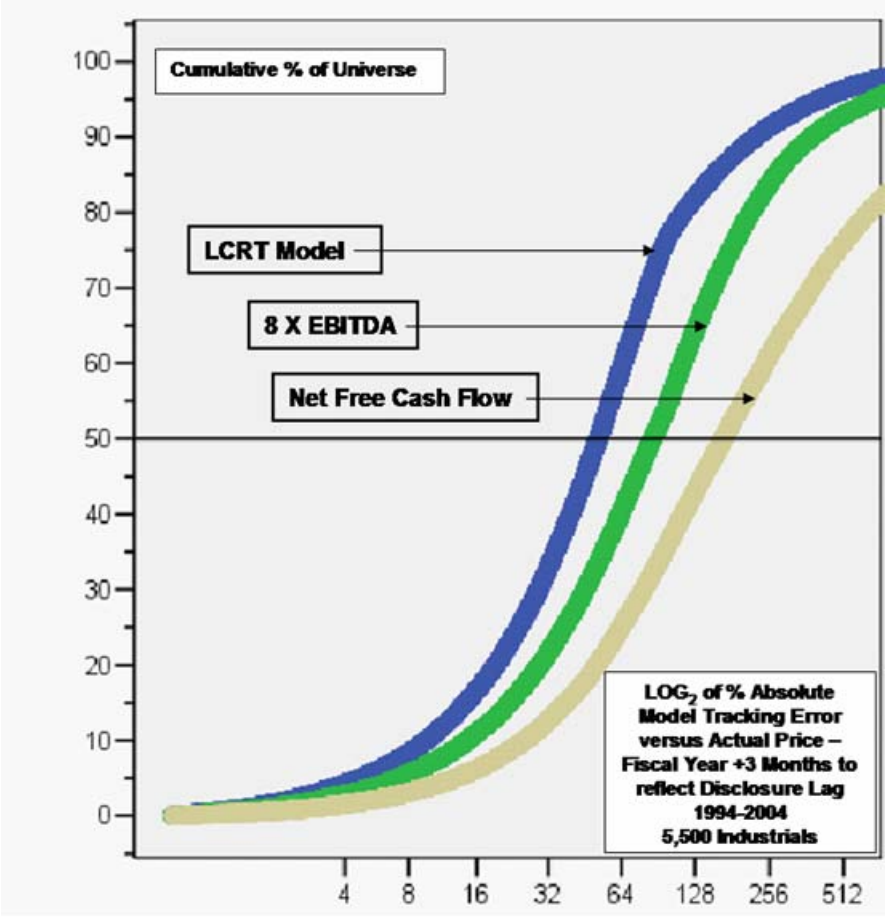
[51] The LCRT ValuFocus product displays the results of five models applied historically to approximately 7,000 companies for the last 10 years.

[52] Based on raw financial statement data and stock prices from Hemscott plus calculations from the LCRT Research Platform.

In the chart below, the horizontal x-axis measures the log to the base 2[53] of the absolute model intrinsic value tracking error versus the actual stock price, while the y-axis measures the cumulative % of the universe. The most accurate models are up and to the left with the lowest tracking errors. The least accurate are down and to the right with the largest tracking errors. The median tracking errors are 166% for net free cash flow, 86% for 8 X EBITDA, and 51% for the LCRT fade capitalization model.

The simple 8 X EBITDA model is more accurate than the net free cash flow model. These results may help to explain why security analysts and portfolio managers prefer simple multiples over DCF net free cash flow valuation models. The LCRT fade capitalization model is the most accurate of the three.

Again, these comparisons illustrate an objective *empirical research process* for testing models and improving DCF valuations.



[53] Using a log transformation spreads the data out to more effectively distinguish the model differences.

Conclusions: The capability to relate annual performance measures derived from accounting data to company internal rates of return and intrinsic value by using computer modeling represents an extremely powerful way to conduct monitoring and analysis with minimal analyst intervention. The LCRT Research Platform contains many procedures and methodologies which differ from conventional valuation methods and offers a way to test the reasonableness of intrinsic values derived. Differences highlighted during reconciliation may suggest important considerations overlooked in the application of the conventional Discounted Cash Flow Analysis.

In addition to serving as a reasonableness check, the LCRT valuation technology raises important questions about existing, commonly accepted methods:

1. Should models display a confidence measure?

2. Should models explicitly consider inflation in both historical analysis and future projections?

3. Do existing models assume a declining rate of output from fixed assets as they are depreciated, and – if so – is that assumption correct?

4. Should DCF assumptions be explicitly tested for sensitivity, and what should be done with the findings?

5. Can analysis of historical performance provide the means to ascertain more reliably future projections compared to management / analyst projections?

6. Can a company with an unusual capital structure or abnormal near term growth be valued using a single period capitalization model which incorporates a formula for 'fade' to obtain a normalized structure and growth over time?

7. Are public guideline comparable companies better selected by using economic measures alone instead of screening by industry?

These are just a few of the questions that arise when looking at the LCRT program and its potential applications to the private securities market. In this paper, we have identified 17 key points relevant to privately held valuations performed by appraisers:

1. Wide acceptance of the Discounted Cash Flow model (DCF) has produced complacency. The LCRT Research Platform offers a way to empirically test for reasonableness.

2. Different analysts using DCF can honestly arrive at significantly divergent company values.

3. Most appraisers employ a multi-period model.

4. Besides the multi-period model, the Capitalization Method represents another model using discounted future economic benefits.

5. Theoretically, both the capitalization and the multi period discount models should return the same value. Often, however, obtaining a reliable estimate of long term growth becomes difficult, if short to intermediate term growth varies considerably from the long term.

6. Most appraisers have adopted the use of net free cash flow discounted to net present value as their preferred economic benefit to model companies and account for returns. Analysts input 20 or more assumptions into DCF models, all based on professional judgment.

7. The authors suggest a *baseline* intrinsic value model approach as one empirical way to evaluating DCF output for reasonableness.

8. The "Value Chart," first employed by Value Line in the 1930's to visually portray its valuation of companies, represents a powerful research tool to assess the accuracy of valuation models and establish empirically validated *baselines*.

9. Selecting and applying public company information for private company valuation represents accepted practice.

10. Traditional appraisal valuations usually employ industry as the primary screen for comparables. LCRT, by default, chooses public companies based on economics alone.

11. The Cash Economic Return builds on the work of Solomon, Salamon, Ijiri, and Madden to create an annual economic return measure for the whole company.

12. LCRT makes important adjustments to the conventional measure of net free cash flow. It uses fading growth rates to drive asset levels and fading Cash Economic Returns applied to those asset levels to drive gross cash flows (net income + depreciation).

13. The LCRT Research Platform substitutes "fade" in place of discrete forecast periods to obtain normalized structure and cash flow over time. *Of great research significance, employing a single period model enables extensive empirical testing of several models applied to thousands of companies over a decade.* Fade represents the single most important tool that permits the analyst to utilize a capitalization model rather than a multi period forecasting model.

14. The LCRT real discount rate derives from the universe of public stocks, and the same discount rate applies to all individual securities. LCRT does not specifically build up the discount rate or adjust it for unique risk in the same manner in use by most appraisers today. LCRT's proprietary fade and other adjustments place traditional risk into certainty equivalent cash flow forecasts built into the model.

15. The proposed fade capitalization valuation model and associated empirical testing Research Platform offers a totally different method for valuing a private firm and a reasonableness check on findings.

16. The Value Chart for individual companies compares the annual spot intrinsic values for the three or more capitalization models for each year. Tracking errors measure the accuracy of the models.

17. A chart comparing the cumulative % of firms against the absolute value of the tracking error effectively compares the accuracy of several models over a large sample of companies.

The Discounted Cash Flow Model, or DCF, resides at the very "heart of valuation." The model permits understanding about value from the most important perspective of all – the likelihood and amount of receiving future financial benefits. The authors have suggested two research measurement methodologies to test for model accuracy –

- Value Charts with Tracking Errors for individual public companies and

- Cumulative Tracking Errors for large samples of companies to improve DCF models through extensive empirical testing. It also suggests that a model based on Fading Cash Economic Returns derived from traditional financial statements provides the conceptual and empirical basis for dealing effectively with competitive reaction and its likely impact on the future cash flows of the firm.

The authors hope that this presentation stimulates additional debate about the important underlying assumptions in the commonly accepted valuation methods generally and the Discounted Cash Flow Model as it is presently used specifically.

FOOTNOTE REFERENCE SUMMARY

(1) Rawley Thomas, President of LifeCycle Returns, Inc. (LCRT), St. Charles, Illinois. Thomas can be reached at 630.377.0761 or Rawley@LCRT.com. LifeCycle Returns supports investment funds, consulting firms, securities and valuation analysts, and investment banks with process consulting and licensed platforms.

(2) Randall (Randy) Schostag, President of the Minnesota Business Valuation Group (MBVG) (http://www.BusValGroup.com). He is certified as a CFA, MCBA, ASA, AVA, BVAL. For more information he can be reached at 612.240.0309, 800.303.2889, or RSchostag@BusValGroup.com.

(3) Pratt, Shannon, Reilly, Robert, Schweihs, *Valuing a Business* (New York: McGraw-Hill, 2000), p. 152.

(4) Pratt, Shannon, *Business Valuation Body of Knowledge, Exam Review and Professional Reference* (New York: John Wiley & Sons, 1998), p. 82.

(5) The authors have used net free cash flow in this article rather than free cash flow, a term first set forth by Modigliani and Miller in the Journal *of Business* in October 1961. Net Free Cash Flow is a term and method more familiar to valuation professionals.

(6) Pratt, Reilly, Schweihs, p. 153.

(7) Aswath Damodaran: Professor of Finance and David Margolis Teaching Fellow, Stern School of Business, New York University. MBA and Ph.D degrees from University of California at Los Angeles. Research in valuation, portfolio management, and applied corporate finance. Author of *Corporate Finance: Theory and Practice.*

(8) Damodaran, Aswath, *Investment Valuation, Second Edition* (New York, John Wiley & Sons, 2002), p. 18.

(9) Pratt, Reilly, Schweih, p. 154.

(10) Pratt, p. 82.

(11) A model for determining the intrinsic value of a stock, based on a future series of dividends that grow at a constant rate. Given a dividend per share that is payable in one year, and the assumption that the dividend grows at a constant rate forever (in perpetuity). *Investopedia.com,* 2000. J. B. Williams first developed these formulas in *The Theory of Investment Value* (Harvard University Press, 1938). M.J. Gordon and Shapiro rediscovered them in "Capital Equipment Analysis: The Required Rate of Profit," *Management Science*, October, 1956, pp. 102-110.

(12) Pratt, Shannon, *Cost of Capital* (New York, John Wiley, 1998), p. 118. "All DCF cost of equity models are rooted in the Gordon Growth Model

(13) Wikipedia at http://www.wikipedia.com: Sensitivity analysis is the study of how the variation in the output of a model (numerical or otherwise) can be apportioned, qualitatively or quantitatively, to different sources of variation. The technique offers a way to characterize the uncertainty embedded in a model.

(14) Or model structure.

(15) Robert Shiller in "Do Stock Prices Move Too Much to be Justified by Subsequent Changes in Dividends" (American Economic Review, Vol. 71, No. 3 (June 1981), pp. 421-436), compares prices for the market to an intrinsic value derived from a dividend discount model. He observes that prices are much more volatile than the intrinsic values, as the reader may discern from the 'Value Chart' for this individual firm. Behavioral Finance hypotheses and technical analysis suggests investor psychological herd behavior causes stock prices to oscillate around intrinsic values, both at the market level and at the firm level.

(16) *Value Line* publishes more than a dozen print and electronic products serving more than half-a-million investors for timely information on stocks, mutual funds, special situations, options and convertibles. Investors and analysts best know the company for *The Value Line Investment Survey*, which, according to the company, is the most widely used independent investment service in the world. *The* Survey is a comprehensive source of investment information and advice on approximately 1,700 stocks, more than 90 industries, the stock market, and the economy. See http://www.ValueLine.com for further information.

(17) CMA became Callard Research which became Ativo. John Lafferty of Lafferty Associates also learned from Chuck Callard.

(18) In 1985, Bob Hendricks, Eric Olsen, Marvin Lipson and Rawley Thomas co-founded HOLT. The last names of the four principals created the H-O-L-T name. In 2001, Thomas at LCRT began employing Value Charts to display results for multiple models.

(19) Application of these valuation models include stock investment decisions and business unit strategic planning to assure stockholder wealth creation. LCRT back tests suggest excess investment returns occur as price migrates toward intrinsic value over several quarters.

(20) Non-Earnings margin is the part of Cash Economic Return as a % of sales not represented by earnings. Technically, it equals gross cash flow less earnings or depreciation and amortization plus inflation adjustments as a % to sales. Please refer to later discussion on Cash Economic Return.

(21) Thanks to Tom Copeland for suggesting that this methodology effectively separates the migration of price toward intrinsic value based purely on history from the migration of price toward analysts' forecasts.

(22) Stewart, G. Bennett, *Quest for Value* (United States of America, HarperCollins Publishers, 1999). EVA® is a registered trademark of Stern Stewart.

(23) Slee, Robert T., *Private Capital Markets* (New York, John Wiley & Sons, 2004), p. 112.

(24) Slee actually discusses differing value worlds and as such is not directly applicable to the authors' theory.

(25) But with important differences related to the treatment of depreciation, accumulated depreciation and inflation which LCRT suggests translate to improved empirical model accuracy.

(26) Revenue Ruling 59-60, 1959-1,C.B. 237.

(27) RR 59-60, Section 2013(b) does not detail how to select guideline public companies, but, in addition to industry, stipulates economic comparability. The authors believe that while most appraisers fulfill the industry screen, but pay less attention to economic comparability. LCRT's screen reverses that process, viz., the economic screen becomes the most important.

(28) As Yuji Ijiri observes ("Recovery Rate and Cash Flow Accounting", Financial Executive, March 1980, pp. 54-60), investors should not care to what industry the firm belongs or what type of assets it purchases, only how well the firm employs the investors' cash investment to generate cash returns for the investors' benefit.

(29) Pratt, Shannon, *The Market Approach to Valuing Businesses* (John Wiley & Sons, New York, 2001), p. 51.

(30) Economic comparables differ from traditional comparables, because economic comparables divide the universe into firms with similar cash economic returns, size, asset life, leverage characteristics, and asset mix between depreciating and non-depreciating assets. Searching the data base for 10 years may produce 50 to 200 economic comparables and provide a range of values based on the % under (over) valuation of all the firms selected. The LCRT model derives unbiased intrinsic values with 50% of the firms under valued and 50% of the firms over valued.

(31) LCRT has conducted many tests, the contents of which are available on request.

(32) Pratt, Shannon, *The Lawyer's Business Valuation Handbook, Understanding Financial Statements, Appraisal Reports, and Expert Testimony* (American Bar Association, Chicago, Illinois, 2000), p. 228-236.

(33) Miles, Raymond, *Basic Business Appraisal* (John Wiley & Sons, New York, 1984), p. 294, 272-277.

(34) *Advanced Communication Design, Inc. v. Follett,* 615 N.W.2d 285, 293 (Minn. 2000). This case, in which Schostag was one of the appraisers, established a bright-line rule requiring proof that the payout in a shareholder dispute would not harm the firm.

(35) *Robinson v. Robinson,* WL 237200 (Ohio Ct. App. 1990) and *In re Marriage of Griepp,* 381 NW, 2d 865 (Minn. Ct. App. 1986).

(36) Pratt, Reilly, Schweih, pp. 437-448. Valuation Synthesis and Conclusion.

(37) Ibbotson Associates have provided discount rate information for analysts (among other products and services) since 1977. See http://www.Ibbotson.com.

(38) The same function based on company asset size applies to all firms in the super sector industrial universe. Institutions and individuals signing the non-disclosure license agreement may view the complete audit trails of all calculations within the LCRT Platform for all companies for all years in Excel and Visual Basic.

(39) Earnings Before Taxes, Interest, Depreciation, and Amortization.

(40) During 2005 LCRT introduced a *ValuFocus* product for users to obtain rapid, albeit limited confidence, calculations on the 8 X EBITDA rule of thumb, as well as other models.

(41) LCRT's back tests suggest excess returns and general economic performance migrate toward historical intrinsic spot values over time.

(42) See Richard P. Brief, ed., *Estimating the Economic Rate of Return from Accounting Data,* Garland, New York, 1986. See also, Richard P. Brief and Raef A. Lawson, "Approximate Error in Using Accounting Rates of Return to Estimate Economic Returns," *Journal of Business Finance & Accounting,* January, 1991, pp. 13-20 and "…A Correction," November 1991, pp. 915-916.

(43) Madden, Bartley J., Cash Flow Return on Investment (CFROI) Valuation: A Total System Approach to Valuing the Firm, Butterworth Heinemann, Oxford, 1999.

(44) Yuji Ijiri, "Recovery Rate and Cash Flow Accounting," Financial Executive, March 1980, pp. 54-60.

(45) For RONA to be comparable to the IRR, output must decline linearly with the increase in accumulated depreciation and inflation must be insignificant.

(46) See Richard P. Brief, Estimating the Economic Return from Accounting Data, Garland, New York, 1986, and Richard P. Brief and Raef A. Lawson, "Approximate Error in Using Accounting Rates of Return to Estimate Economic Returns", Journal of Business Finance & Accounting, January, 1991, pp. 13-20 and "…A Correction", November 1991, pp. 915-916.

(47) Small start-up firms form an exception to this pattern as the market prices those companies as though the average survivors will achieve superior returns above the average. Effectively, investors purchasing small start-ups are buying on option on superior economic performance on the IPO cash invested in operating assets.

(48) Higher inflation rates increase the spread between accounting returns on historical depreciated cost over inflation adjusted Cash Economic Returns.

(49) Source: Raw data from Standard & Poor's Compustat; Inflation adjustments from LifeCycle Returns, Inc.

(50) Lewis, Thomas G., Daniel M. Stelter, Thomas Casata, Monika Reiter, *Steigerung des Unternehamenswertes (Total Value Management),* Verlag Moderne Industrie, 1994, pp. 244-247.

(51) The LCRT ValuFocus product displays the results of five models applied historically to approximately 7,000 companies for the last 10 years.

(52) Based on raw financial statement data and stock prices from Hemscott plus calculations from the LCRT Research Platform.

(53) Using a log transformation spreads the data out to more effectively distinguish the model differences.