Rational Investing

A System for Free Cash Flow Estimation And Valuation of Corporate Securities

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Rational Investing: A Standard for Free Cash Flow Valuation

SUMMARY

The Rational Investing Cash Flow Engine was created in response to the valuations of technology stocks in the late nineties, to reconcile the traditional notion of a Discounted Cash Flow with the unusually high securities prices observed at the time. Today, it generates a Standard Value[SM] for a firm using high quality cash flow data projected without bias, using a forward looking cost of capital that reflects the real risks of owning publicly traded securities. The systematic incorporation of fundamental measures of a firm's health facilitates a consistent understanding of equity value for the entire global market under a variety of macro conditions, generating proven market neutral alpha.

STANDARD VALUE A single valuation template parses financial statements for valuation from the public investor's point of view, fitted to the business cycle. This allows it to rank valuations across sectors in a highly scalable fashion suitable for market neutral quantitative investing or for managing the risk of institutional portfolios. The result is an order of magnitude better Sharpe Ratio than the typical fund at an order of magnitude lower cost, i.e. a 100-fold improvement in productivity.

Through a decade of research, we developed a nuanced understanding of the relationships between financial statement trend lines and multiple risk factors, measuring the sensitivity of the firm to the health of the economy, and capturing the market's *expectation* of Beta adjusted return, i.e. an understanding of how information impacts probability assignments of future changes in cash flow and expected value by public investors. The following steps generate a risk adjusted valuation for a public security:

- **Calculating and Projecting Free Cash Flow.** We project the cash flow generation capacity of the firm defensible through the business cycle within a 10 year horizon, by using cash only line items from SEC or other corporate filings. An identical set of formulae is used for every company no matter what its industry sector or geography, with well-defined event processing and error correction by analysts. Each line item projection uses mathematics to estimate future year values. The firm's evolution into a growing annuity of terminal FCF is driven by trends in its recent revenue and cost structure as well as the true eventual costs of running the business; the cash flow and terminal value are then discounted by returns commensurate with those trends and balance sheet risks, as explained below. We incorporate capital expenditures and equity issuance as costs of growth. Non-US companies are normalized to approximate US accounting conventions. Many countercyclical assumptions offset the impact of the economic cycle and / or volatile product cycles or business conditions.

- **Injecting Data.** The supporting step is to automatically populate historical data in conjunction with 'economic scrubbing' of accounting statements. We use the latest 3 quarters and 2 years as necessary and sufficient information to extrapolate financial statements forward. 'Economic scrubbing' strips out of non-cash items except taxes, offsetting changes in accounting methodology, processing events such as spin-offs, mergers, JV's, error checking or dampening trend lines from one time fluctuations in line item amounts, commodity reserves and risk hedges extracted from footnotes, etc. In most research efforts, analysts will do this idiosyncratically for each firm. We have significantly standardized such corrections. This highly formatted approach allows us to reduce the cost of a traditionally expensive task. ***Economic scrubbing in the context of a transparent spreadsheet valuation is a significant and resilient source of alpha.***

- **Expected Returns.** The third step is to generate discount rates at which the free cash flow of the firm, and separately, cash flow to equity, should be priced. Our calculation models the risk aversion of public investors distinctly from that of private buyers. Because of the additional cost of information, public markets have a skew towards growth, and in point of fact growing firms go public, and mature firms with declining cash flows are taken private. Additionally, monetary policy manipulating the term structure of risk free rates alters risk aversion i.e. the Fed affects the equity risk premium, lowering it when it pushes down the risk free yield curve or vice versa. This has limitations, as the low Treasury rates accompanied by high LIBOR in the spring of 2010 demonstrated, and we have modeled to a degree the nuances of the equity market's response. Our valuation incorporates a firm's leverage, cash flow margins and their cyclicality, growth and size as factors in the cost of capital. It also incorporates the impact of commodity prices, the R&D or CapEx required to maintain margins, and regulatory burdens. We quantify the risk impact of hard assets and competitive position. **These factors are interlinked to define conditions under which they are effective to various degrees; this is a unique element of our decision tree.**

- **Liquidity and Capital Structure.** The final step is to project the liquidity of the firm by measuring its minimum and expected financing needs based upon available cash flow, maintenance Capital Expenditure, and typical M&A and other capital markets activity. Here, we incorporate the impact of non-operating income, as well as the reliance upon short term financing. This step helps understand if a firm is going to face material refinancing risk with respect to credit or rate exposure. It also generates a simple analysis of enterprise value where we compare the value of the firm with the value of its components i.e. debt, taxes, equity. The difference gives information about default risk.

This process, applied over time to 5,000 domestic and international stocks and ADR's, yields an apples to apples comparison by which the cheapest and most expensive companies are identified. Our feed's returns have a Sharpe of 2.5 in a market and sector neutral strategy across the US, UK and Japan, 10x that of the S&P500. As a side-effect, the process clearly highlights cheap or expensive sectors and sub-sectors.

MODELING OBJECTIVE - STANDARD VALUE

The genesis of this product was in observing the valuation of internet and technology stocks in the late nineties. The market value of the tech sector represented a challenge to traditional corporate finance theory. The underlying firms had very high, in some cases accelerating, growth rates. They were very small, few of them made money based on GAAP, and free cash flow was usually negative. Yet, this situation was welcomed by the capital markets, despite the fact that a major portion of these firms' labor cost was hidden in equity issuance in the form of options. Some firms acted like biotech companies, going public with little even in the way of revenues, often lacking the clear efficacy parameters and distribution available to the biotech sector. Despite the low expected returns modeled by traditional tools, buyers of these securities were experiencing high capital appreciation and expected that to continue indefinitely into the future. In 2007 - 2008, many commodity driven stocks behaved similarly. Our worldview resolves the dichotomy between traditional metrics and the prices of such stocks.

The objective of applying our model is to standardize the valuation of a publicly traded firm based upon the extrapolation of free cash flows, discounted using forward looking risk adjusted returns applied consistently to the entire coverage universe. The valuation assesses the market's estimate of probability distribution of outcomes in the firm's value in response to the economy, a true Beta. Our system solves the mystery of the wildly different prices paid for 'momentum' vs. 'value' stocks and is effective across all investment styles, with a clear understanding of relationship between the stock price and the expected evolution of the costs as well as growth of a firm. The cost of capital used to compute NPV significantly upends traditional CAPM thinking based solely on historical relationships. This standardization of approach and results is achieved at a cost an order of magnitude less than that of traditional analyst teams.

Projections Based on Decision Trees Implement Contingent Economic Relationships

An important facet of our model is that we use a parallel logic of decision trees rather than a statistical approach, to investment decisions. The output is expressed within a spreadsheet, in a format easily recognized by analysts. This also allows for minimal computing needs for a fairly complex pattern recognition problem, as well as the ability to construct a single set of valuation logic in a spreadsheet template that absorbs rather than ignores most outliers. This single valuation template works for all stocks across all sectors. The uniformity proves intellectually and practically important. Intellectually, it is harder, but critical to come up with a general set of rules rather than sector specific ones. Once in place, it is easier to comprehend unsolved problems in a single risk calculator. Practically, uniform logic is required for scalability, else engineering changes have to be propagated across many sets of sector or situation specific code; a task which would eventually become impossible to do.

The focus on reasonableness of projected economic relationships rather than strictly

rationalizing past ones also allows the model to respond to structural changes in a sector, rather than treating them as 'outliers' until they alter established relationships over a long period of time. Strictly statistical approaches to understanding corporate finance face significant hurdles because of an unsuitable toolkit: future outcomes are based on current economic circumstances, such circumstances or contingencies evolve through corporate events or competitive or regulatory change in the marketplace, making it questionable whether historical relationships remain valid.

We focus on cash flow based rather than asset based valuation because asset quality is harder to evaluate quantitatively with information available to public shareholders, and its evolution is even harder to foresee in any systematic fashion. Hence we do not presently include banks, insurers, precious metals firms or highly regulated utilities in our universe. We include financial brokers who use mark to market accounting, with some success. Our approach is meaningful for asset rich firms which have operating limits on the rate at which they can extract value from such assets e.g. a company can own a lot of oil in the ground, but if only a certain amount can be extracted per year given current technology, that revenue stream is a better assessment of value to an equity investor than the entire sum of oil underground. To a private investor, such an asset might represent a store of wealth, and to a limited extent that fallback value impacts a public investor's risks too.

ECONOMIC SCRUBBING AND VALIDATION OF DATA

A large part of our ongoing process to support a production system is checking data for changes in accounting policies, events e.g. significant mergers or divestitures or plant shutdowns, restatements, inconsistency between statements, small acquisitions or write-offs, changes in fully diluted shares through option issuance or buybacks, inclusion of non-cash items in costs, mixed allocation of research, exploration, development, related expenses and CAPEX due to the capitalization of certain costs, breakdown of charges between cash and non-cash items, natural events e.g. earthquakes and accidents etc. that temporarily throw off projections. Any data vendor's main objective is to provide an accurate electronic version of what the company reported, and capture human error even if it originates with the filing firm. We call this numerical scrubbing. Our principal effort, on the other hand, is geared towards 'economic scrubbing', i.e. our software adjusts models for accounting items and corporate events listed above and then we look at models with extreme valuation movements or large changes in costs relative to changes in revenue, to determine if the model reflects the economics of the firm reasonably. We continue to automate such checks and adjustments, so that manual intervention is required only when there is an anomalous outcome or with international data which needs extensive cross checking or often triangulation. Nevertheless, application of human review occupies half our resources with US data, and is far more labor intensive in the case of non-US data. We are able to do such economic scrubbing in the context of a transparent spreadsheet which clearly identifies outlier valuations. Such final quality of trend data as ours is simply not available in the market and is an important part of the value created by our models.

Changing Accounting Practices and Corporate Events

Movements of costs between line items can be surprisingly frequent even in the largest of firms and often without any stated reason. Any reasonable notions one could have about the stability of cost allocations within firms would get disabused over a couple of quarters of scrubbing. In other instances, a continuum of cash charges have become a regular feature of the management's reporting; CapEx is hidden as M&A, interest rate risk is hidden in swaps, and so on. Adjusting for such items requires going through the footnotes as well as projecting a trendline of costs different from guidance. The opposite can also be true, where JV's and unconsolidated subsidiaries add to a firm's cash flow value and yet a set of measures focused on the main filing data could miss them completely. Projecting refinancing risk is also a significant task that results in a far clearer understanding of the firm's value. Our formulae and switches highlight, correct for or dampen the impact of capital structure, acquisitions, and other events that would otherwise throw projections and valuations off. e.g. The model accommodates a rollup – there is a continued string of acquisitions that is expected to continue. Rollups also, by virtue of generating fees for their sell side cheerleaders, trade at a premium until the business model hits a wall.

A change in accounting practice should not be confused with a change in business model. More than occasionally, however, the firm has really changed the business it is in – going from producing pulp to selling paper and office supplies, or from producing energy under regulated profit margins to trading derivatives in a de-regulated one. In such instances, the value of historical information becomes quite limited. By relying on less than three years of data, our model adapts quickly to a new competitive environment for a firm.

PROJECTION

Our methodology allows for a single template to cover all industry sectors as a result of sophisticated mathematical interpolation techniques; differences between different industry sectors have been reduced to a set of parameters where values represent a blend of risks specific to that industry sector while applying general principles of economic cycles and competition to the template. The result, combined with the scrubbing described above, is consistent financial statement line item projection logic for growing, shrinking, and cyclical or otherwise volatile firms in various stages of their life cycle or an economy's or sector's business cycle, including those dependent on the outcome of concentrated product development, extreme seasonality in revenue, or commodity prices.

Techniques learnt in the government bond and FX worlds have been applied in this system to model income statement, equity outstanding, debt service coverage and refinancing projections. For decades, the fixed income business has routinely relied upon modeling solutions comparable to ours to calculate present value of securities by

applying parameters and interpolation techniques to gaps in available information. This technology is far less prevalent in the equity world. The uncertainty of cash flow, unlike the known coupon of a bond, as well as the ineffectiveness of historical correlations in any arbitrage worthy time frame in setting a discount rate, led to very few quantitative resources being applied to discounted cash flow equity valuation. Most analytical systems are either focused on trading oriented statistical arbitrage, which includes but is not particularly beholden to fundamentals, or corporate finance oriented Economic Value Added analysis, which ignores the cost of information, the yield curve, and other forces that impact public investors and was meant as an internal advisory rather than public investment technique. As a result, constructing valuations suitable for fundamental money management remains labor intensive and practices vary widely.

Our Standard Value is the result of a consistent framework aimed at scaling the analysis of public securities. Revenue growth is projected in order to reduce it by the 10^{th} year to a range around GDP growth, after which a perpetuity formula is used to calculate terminal value of cash flows. The target price can be used for relative valuation vs. any company worldwide and, at the mean, has proven reasonably accurate in its own right.

Financial Statement Trend Extrapolation

The economic relationships in our projection logic have been refined over many years, and take a firm as is and create convergence with firms with comparable risk characteristics, whether in its industry sector or beyond, and the economy it belongs to over a horizon of 10 years. If the firm is doing far better than its peers, it will grow into median performance. If it is doing much worse, it will eventually be restructured or bought out by a better management, though it presently carries some distress risk. This can be generalized to an industry. If the business is 'hot', capital will flow in, and competition will drive down margins to sustainable levels over time. If it is not doing well, consolidation will occur until the survivors can earn meaningful returns. There are exceptions – a deflationary environment identified by extremely low discount rates is one - which can indicate overwhelming macroeconomic problems where countercyclical assumptions do not hold as well as the market for corporate control might have failed, and we have safeguards against such situations. The exception can also be one of extreme success - markets are suspicious of giant monopolies and treat their unique competitive positions as somewhat more tenuous in the long term than the typical firm's.

If the industry sector is cyclical and there is a downturn in the economy or the underlying commodity driving its revenues, then in a majority of cases it is assumed that revenue in a succeeding year would 'bounce back'. This thinking can also be applied to commodity costs. Even if a firm is growing exponentially, terminal growth is projected at no more than 8% i.e. about 2x nominal GDP growth. If an industry is in decline, e.g. broadcast television, then the decline in revenues would be reduced over time, and after a few years modest revenue growth is restored, assuming management finds additional lines of business or the sector consolidates, so that it again has low growth and its terminal growth equals inflation i.e. approaching 2%. If one were to assume continuously declining revenues for an industry sector, then projected CapEx in that space would be

below maintenance. In any case, such firms are typically cash cows, and candidates for going private. For public investors, firms which fail our criteria for countercyclical assumptions must offer returns comparable to venture capital to avoid becoming 'value traps'. While individual sectors or stocks might do better or worse, these are reasonable modeling assumptions for a 10-year horizon.

Once non-cash items are removed, the model accounts for maintenance and investment CAPEX as a cost of doing business. Prima facie expectations in this area can mislead e.g. maintenance capital expenditure can be pushed down temporarily for a chain of restaurants or a fleet of trucks, but when they reach a certain age, they will all have to be refurbished or discarded. Our formulae are focused on economic returns, and can vary significantly from information the company might provide in its near term 'guidance'. The software strips out accounting changes from trends in costs and attempts to target a terminal operating margin, but accommodates corporate events, where a new cost structure might be stable and not a temporary deviation.

Taxes

While information is available on marginal tax rates at the state and federal level, individual firms face varying effective tax rates on net income. We gradually raise effective marginal tax rates from those paid today towards the sum of federal and local marginal rates over the course of 10 years. If a firm is currently not profitable, then the application of taxes is delayed to account for loss carry-forwards. Some firms, e.g. oil and resource companies, can face punitive tax rates – these are estimated from effective taxes being paid currently, to the extent possible. Our tax projections can intentionally ignore short term volatility generated by complicated depreciation rules and credits.

Equity Dilution and Maintenance Capital Expenditure

The issuance of new shares to finance the business is treated as a direct cost to the firm and one that impacts its per share valuation no matter what the kind of issuance that occurs i.e. whether through options, shares, or convertible bonds. Such management behavior is also projected forward, penalizing equity value. The reverse occurs in the case of buybacks, assuming they are not executed with borrowed money. This methodology is a creation of Rational Investing, and for many years, was an important reason our models were at odds with those of the broker / dealers, and rightfully so.

This issuance is projected to go down over time, presumably as the firm becomes more valuable and attractive to employees, so that the growth of number of shares slows faster than the slowdown of revenue growth. The faster slowdown for equity issuance compared to revenue growth also offsets the double counting (as an expense) of the portion of cash raised which is consumed in the current year. This is generally not a serious discrepancy for valuation purposes, because cash raised from employee option exercise is usually at a strike prices materially lower than the market price. Treating option issuance as a direct cost is now a norm, years after we recognized its economic value in our models.

Share buybacks are assumed to continue by using a certain portion of cash generated.

Another form of paying employees is having above-requirement maintenance CapEx. This is often seen in markets where the government maintains implicit control over large firms, often ex-public entities that were privatized or where there is a lot of financing by regulated entities, and pushes them into having more 'investment' i.e. employment than would be ideal from the equity holder's point of view. The model accommodates this situation in its maintenance CapEx calculation quite well in most circumstances.

DISCOUNT RATE

This step began as an intuitive effort because merely scrubbing cash flow and projecting it reasonably did not value firms in many sectors anywhere near where the market was trading based on textbook CAPM / WACC rates. We added and tuned the impact of a number of risk factors potentially significant to valuation. Simulation results subsequently offered validation of our economic logic. For those interested in theory, the empirical basis of risk spreads implied from an observed rate of return is tenuous, partly because it is an argument about historical numbers that cannot be observed directly: At some point in the past, what risk premium did people *expect* from capital assets looking forward at the time of the investment? It may be the same as actual returns over those 3 or 30 years, but that is uncertain if not unlikely. A number of events over time would have changed the risk premium for any one factor in a model if not equities as a whole, so that actual returns were quite different from those expected when investing. The assumption may only be true averaged over a decades-long period.

So a starting point is about 550 basis points over the 10 year Treasury, a number first calculated by Ibbotson Associates as the historical additional return of stocks for a period of 75+ years. Our concern is how the ‘typical’ premium is impacted by money supply and a firm’s financial and operating condition, as well as tax policy. It is also proven that smaller firms earn higher returns, and at the extremes small cap value has historically delivered a double digit spread to large cap growth. Since small cap returns are far more volatile the more interesting question is what the risk averse expected return is, to offer assurance that realized return across a portfolio of small caps is sufficient to offset individual losses. In the US, our model produces a comparable market neutral Sharpe Ratios across the size spectrum, indicating that the model's size risk aversion is consistent with that of the market.

The Federal Reserve's actions impact risk spreads significantly, aside from lowering the risk free component of the cost of capital. Intuitively, low real returns in the money market lower expected risk spreads in front years from long dated assets, driving capital into the stock market. Conversely, real yields in excess of historical averages at the short end from a shrunken or inverted term structure lead the market to expect significantly

higher returns from capital assets, creating a higher risk premium for stocks. Applying this hypothesis consistently moves valuations closer to the market price.

Another factor is leverage as measured by Debt/EBITDA. Our debt coverage calculation is designed to help estimate equity value rather than a precise debt discount rate.

We also incorporate operating fundamentals as drivers of returns. The risk of most industry sectors is a combination of such components. In our view, the Markowitz-defined 'market portfolio' can be splintered into expected returns tied to high R&D or capital expenditure, litigation, monopolies, working capital needs, counterparty credit risk, event risk, commodity cycles, ownership of rent generating physical or intellectual property. We have looked at each industry sector and quantified how competitive and regulatory forces impact them. Overall, as these items change in a company's financial statements, our model captures in the discount rate the distribution of risks from the rate of change in growth or costs of the firm. E.g. If revenue growth is low or slowing down as a firm matures or faces the law of large numbers, then it is likely that surprises are negative. In that situation, the discount rate gets raised, so that the stock is not as attractive an investment. An additional / alternative step is to lower revenue projections, and in our view what matters is the overall result, rather than being perfectly accurate with one element of logic or the other. The opposite occurs in bull markets, where accelerating growth can push risk spreads close to zero.

This combination of factors exhibits tremendous explanatory power, and withstands testing on a decade of scrubbed data. Our track record is consistent with test results.

DEBT SERVICE

Liability is modeled for most firms where it is of meaningful size. For equity investors, this is immediately important for highly levered firms, or for those that significantly reduce the duration of their liabilities with swaps or short term borrowing. For firms with a stable investment grade or low leverage balance sheet, debt costs can be assumed to be a fixed percentage of revenues with little loss of accuracy in pricing the stock. For debt investors, of course, projecting debt service coverage accurately matters at all times. While we can look up a company's financial engineering in its SEC 10-K filing, the spread to Treasury of a firm's cost of debt capital in light of its overall leverage can be an important and quick indication of its liability duration, and refinancing risks are taken into account in our liability projections and valuation. We can maintain accurate track of fixed vs. floating liabilities for firms from the footnotes of company filings.

In the projection of debt service coverage, EBITDA is adjusted for income from non-operating sources such as equity investments or intellectual property. We assume a percentage of such income to be available as cash. We also distinguish between maintenance and growth CAPEX. Maintenance CAPEX reduces cash available to pay required debt service and taxes. For a projection of expected financing requirements, the

firm's history of acquisitions, fresh investments, and divestitures is projected as well. Interest costs for new issuance are calculated using an estimated spread of fixed rate debt to current 10-year Treasury rates. The impact of leverage on the equity discount rate is muted for firms with substantial assets or intellectual property. Firms growing very rapidly, or with collateral that can be segregated, are treated as cheaper / easier to finance.

Our model on the borrowing behavior of the largest firms can offer meaningful insight. It would seem that, through either swaps or the extensive use of short term debt, firms like IBM reduce their cost of capital to negligible levels, and those such as GE literally act like banks, although this activity has shrunk since the financial crisis. The risk of this 'duration mismatch' was underappreciated in a 20-year bull market for bonds. The market has tolerated higher leverage than it might otherwise (or used to before 2008; written before the crisis, this paragraph now feels ironic.)

ASSUMPTIONS AND FORMULAIC REPRESENTATION

The Sharpe-Lintner-Black Capital Asset Pricing Model (SLB CAPM):

E(Rs) = Rf + Beta * (Rm – Rf)

Rs is the expected return from stocks
Rf is the 1 month t-bill yield or close equivalent (e.g. repo rate)
Rm is the return of the market as a whole.
Beta is the historical correlation of the price of the stock to the price of a proxy for the market, say, the S&P 500 in the US.

An approximate understanding of our Cash Flow Engine's Discount Rate:

E(Rs) = R10 + Beta * f(f(Rm-R10), f(R1,R10, LIBOR), f(Yield, Leverage), f(Size, Growth) , ∑f(Operating Metrics))

R1 is the yield on 1 year Treasury bonds.
R10 is the yield on 10 year Treasury bonds.
Yield is the market or modeled yield on the firm's long term debt, or securities superior to the one for which expected return is being estimated.
Size is the size of the firm by market capitalization.
Growth is revenue growth rate across various time measures.
Operating Metrics are factors added to accommodate margins, commodity price / business cycle exposure, brand strength / regulatory issues and other sources of revenue volatility, high reinvestment rates, etc.

The CAPM literature focuses on t-bill rates as risk free expected returns. However, most markets use the 10 year government (or AAA swap) rate as a benchmark for pricing risky assets, hence as a practical matter our approach works fine.

APPENDIX A: CAPITAL STRUCTURE

The follow on objective is to examine the capital structure of a firm to see how value is distributed between equity and debt. This requires projecting the firm's liabilities. The value generated by leverage begins as a positive amount as tax savings dominate at low levels of indebtedness, but as leverage rises or there is macroeconomic distress, bankruptcy risk begins to dominate, and destroys value. Our simple capital structure modeling results typically clarify this.

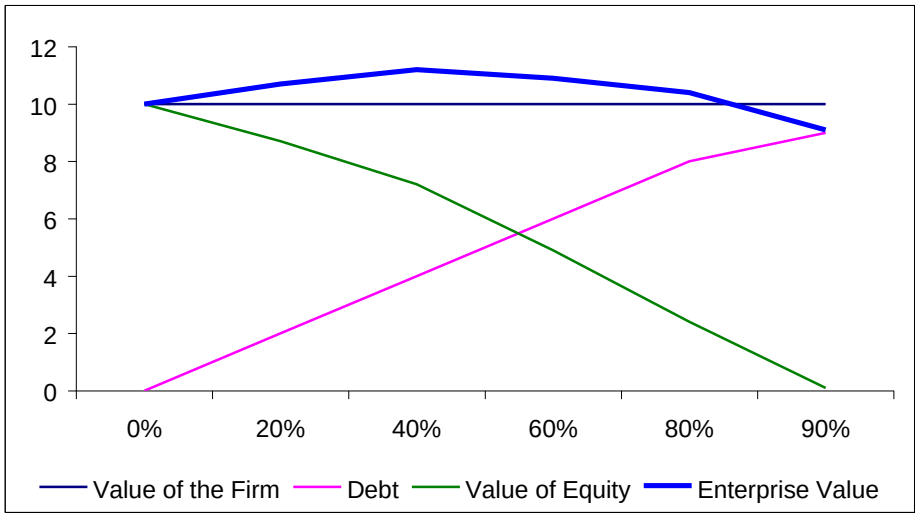

Figure 1. Impact of Leverage on Enterprise Value

Based upon the Miller Modigliani theorem, the value of the firm should not be impacted by its capital structure, ignoring taxes and bankruptcy risk. As a corollary, any impact of capital structure on the traded value of the firm should be assignable to taxes and distress.

A simple formula is:

Value of Equity = Pretax DCF value of operating firm
– Present value of debt and expected new financing
– Present value of tax liability
+ Present value of tax loss carry-forwards

$ Value of Probability of bankruptcy = Value of equity – Market cap of fully diluted shares

This is not strictly true where the one concludes that the stock is simply cheap! The stock price, however, must evolve to satisfy this equation, or the gap gets assigned to default probability. We estimate debt cost rather than incorporate traded prices at this time.

VALUE OF A FIRM VS. VALUE OF SECURITIES

An important distinction in our model results is what we call the Miller-Modigliani line: The value of the operating firm is calculated including the impact of CapEx but before the impact of interest, taxes, and equity dilution or stock buybacks. An (estimated) un-levered risk spread is applied to calculate the discount rate for this projection of cash flows. This can help understand the value of the operating entity for an investor in debt or capable of re-negotiating capital structure. It can also explain the duration of cash flows implied by the market price, which obviously does not incorporate our technology for estimating a firms True Beta. After the deduction of interest and taxes, the residual cash flow is discounted using the rate for equity. Our proprietary factors, when applied to either discount rate, may also be tuned differently to each calculation based upon our thesis that the public and private investors have different skews in their risk aversion, partially based on the cost of information for public investors who have limited diligence capability. This can result in significantly different public and private market valuations for a firm. The present value of taxes is calculated using the same discount rate as that applied to equity i.e. the government's payoff is treated like that of any other shareholder.

ENTERPRISE CALCULATION

A calculation of the difference between the value of the firm and that of its securities plus expected financing requirements leads to an understanding of the impact of leverage and, to some extent, simply that of being a public entity. The implied value of default probability is a blended indication of a cheap stock or (default probability * loss in default), calculated as the difference between the dollar value placed on the firm's securities by the equity market and our model's valuation of the firm. (To be clear, this is an analytical tool, the result is not used in our valuation in any fashion.)

The difference between the pre-tax model value of the un-levered firm and the market value of securities i.e. stock price * #shares plus value of debt and taxes represents the value created or destroyed by capital structure.[1] To the extent that it is generated by a recent move in the stock price, it can also be a leading indicator of movement of credit quality. Where the number is positive in the presence of significant leverage, the market certainly considers the firm to be in financial, though not necessarily operating distress. The difference in market vs. model value of the stock represents an implicit dollar value of bankruptcy risk created by the capital structure. This is an ongoing cost borne by the firm when issuing securities. In the absence of high yield debt, in our model it implies that the stock is cheap. This is a different, and we submit, superior, result from the

[1] Our EV currently includes cash on the books, because of its credit implications. Most LBO analyses would strip it out.

default probability typically indicated by Merton models or Z scores. We are going a step further, and putting a dollar value on the information in the capital structure with a 10 year horizon, whereas most models offer a 1-year prediction of default probability and Merton uses the stock price rather than fundamental information as a primary driver of this conclusion.

A negative value of bankruptcy risk implies the securities are valued above the private value of the underlying firm, and the probability of default is remote. We are not tracking 'when issued' vs. spot yields or credit spreads, so this estimate contains a minor error to the extent bond prices have traded away significantly from the issue date coupon. An estimated value of any tax loss carry-forwards is also explicitly stated here.

APPENDIX B: SCALING THE ANALYSIS

An important ability of Rational Investing's systems is to be able to do model generation and other reporting in batch so that results can be produced on the entire data set, a sector, a portfolio or an index. Our system allows the same set of assumptions to be applied to every stock to produce a set of results for a sector or portfolio as a whole. Assuming all methodology errors are equally applicable to each valuation, it is especially useful as an indicator of the 'relative value' of various securities. This allows us to check final results and upload valuations on circa 150 securities a day, with every actively covered security being revalued and reviewed by an analyst once a month.

Index And ETF Valuation

As investors drift toward ETF's and index funds to manage risk, and institutions begin to trade credit derivatives based on a dynamic mix of securities, it becomes important for asset allocation to be able to use rapid valuation judgments on entire portfolios. Such an effort would be impossible without the sort of automation offered by our system. Our system may allow a 'fundamental overlay' on many tactical trading strategies, adding significant value to the returns of such investment processes.

Such financial ratios as those found in the projections of individual models, as well as others calculable from historical information, can be produced by the Analytics section of the system. Not only can an entire portfolio be analyzed, but several portfolios can be compared side by side as well.

Software Engineering and Support

The system is tuned towards the day to day task of running a fund, whether concentrated and manually traded, or extremely diverse and fully automated. Our reports can be produced in Excel or HTML. Information from SEC filings is read into SQL Server, from which models are generated to be scrubbed. The resulting models are used as an input for a batch valuation process that updates our web site www.rationalinvesting.com as well as feeds statarb systems. The site's technology can be used to create rankings based on blended criteria incorporating our valuation models and other metrics. A daily XML feed delivers new models to desktop clients simultaneously with our web site. Private web pages can be constructed to track a specific universe. The technology has been tested for a decade. We check for swings in valuations between runs and between quarters to understand the validity of valuation changes, and trap errors and false positives. Batch results can also be used to set up baskets of stocks as long or short positions.