An Examination Of The Consistency Of Risk Differentials Between Historical Measures Of Risk And The Risk Implied By Economic Value Added®

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ABSTRACT

The corporate world is continually striving to identify an effective means of evaluating management performance. Corporate concern over this issue stems from both the perspective of managerial compensation and maximizing shareholder value. Some companies have used such measures as returns on assets, equity, or investment. Some have relied on other measures like inventory management, trade credit management, or cash management. The common ground shared by these measures is that they rely on accounting measures of firm activity. The weakness of using such means to measure firm performance is that they are driven by a rule-based system, and anyone with sufficient understanding of the rules ***can*** *manipulate the information to present the picture of the firm's performance in a way that may not track with the reality of the firm's performance. This does not suggest that managers* ***will*** *engage in such numerical fiddle-dee-dee; rather, it suggests that the opportunity to do so exists, and must somehow be incorporated into the shareholder's interpretation of the reported performance. This situation leaves firms in the position of needing a better performance measure by which to evaluate the work of its management. One alternative performance measure offered to meet this need was introduced in the early 1980's by Stern Stewart and Company and is known as Economic Value Added or EVA®.(Ehrbar, 1998) The basic premise underlying EVA is an effort to encourage managers and other employees to think and act as entrepreneurs rather than employees.*

CONCEPTUAL PROBLEM WITH EVA'S BETA

Economic Value Added (EVA®) is a proprietary valuation metric formulated by the Stern Stewart Company. This measure essentially estimates the difference between what a firm's assets generate, in terms of operating profit (after taxes, but without respect to fixed financing costs such as interest), and the dollar cost of the capital required to generate such operating profit. EVA can be an effective way to encourage managers, responsible for a firm's day-to-day operations, to remember that a "profitable" operation does not exist until all input costs (including capital costs) are covered. However, the existence of a positive EVA, which is analogous to a positive economic profit, seems inconsistent with the notions of market efficiency put forth by Fama (Fama, 1970; Fama, 1991). The existence of a positive economic profit would suggest that a project (or a firm) has earnings that are not only sufficient to cover all operating costs and all capital costs, but that also yield additional earnings as an added benefit to owners. This condition would normally be associated with a firm that is undervalued in the market. This paper builds on the work of Jones (2003) and Jones and Lowry (2004 & 2005) in that it corrects for an error in the theoretical development of Jones' model and expands the data set used for the empirical analysis.

THE THEORETICAL CONSTRUCT

In its basic theoretical structure, EVA is the excess of after-tax operating income over the dollar cost of capital employed in operations. The dollar cost of capital is determined by multiplying the total capital employed in operations by the firm's weighted average cost of capital. Analytically, this can be stated as presented in equation one.

$$EVA = EBIT(1-T) - TCk$$

Eq.1

Where: EBIT = Earnings before interest and taxes, or the firm's operating income.

T = The firm's marginal tax rate
TC = The total capital employed by the firm.
k = The weighted average cost of capital of the firm.

This research focuses on the last element of the EVA calculation, the weighted average cost of capital (k). Specifically, the focus is on the equity risk implied by the cost of capital used in calculating a firm's EVA and its relationship to the equity risk implied by the calculation of the firm's beta coefficient using historical regression. A firm's historical beta represents its historical riskiness, and the EVA-derived beta represents an estimation of future riskiness – in this case estimated implicitly by Stern Stewart Company in the derivation of the firm's EVA. This study attempts to determine if there is a systematic relationship between the two alternative measures of risk.

The EVA estimate of equity risk can be found by deriving from the reported EVA the cost of capital used to determine it, and then deriving from the firm's cost of capital the beta coefficient implied in its calculation. The first step is to solve the EVA equation (equation 1) for k, which is the firm's weighted average cost of capital (WACC) used to determine EVA.

$$k = [EBIT(1-T) - EVA]TC^{-1}$$

Eq.2

The weighted average cost of capital is defined as the sum of the percentage of the firm funded by each component of capital multiplied by the cost of that capital component. Analytically, the WACC is defined as in equation 3, which can be found in most corporate finance texts.[1]

$$k = w_d k_d (1-T) + w_p k_p + w_s k_s$$

Eq.3

Where: k = The firm's weighted average cost of capital

w_d = The percentage debt in the firm's target capital structure
k_d = The yield to maturity on the firm's long-term debt
T = The firm's marginal tax rate
w_p = The percentage of preferred stock in the firm's target capital structure
k_p = The yield on the firm's preferred stock
w_c = The percentage of common stock in the firm's target capital structure
k_s = The required yield on the firm's common stock.

The percentage weights in equation 3 (the w's) are market value percentages, and are calculated by dividing the market value of the capital component by the sum of the market values of all permanent capital components. The yield to maturity of the firm's long-term debt is the discount rate that equates the current market value of the firm's long-term debt with the present value of the cash flows (interest annuity plus return of capital) of the bond contract. The yield on the firm's preferred stock is found by dividing the preferred dividend by the current market price of the issue. Finally, the required yield on the firm's common stock is found by using the Capital Asset Pricing Model

developed by Sharpe (1965) which holds that the required yield on a risky asset (in this case, the firm's stock) is a function of the asset's level of market risk. The mathematical representation of the Capital Asset Pricing Model is presented in equation 4.

$$k_s = k_{rf} + RP_m \beta_s$$

Eq.4

Where: k_s = The required yield on asset s

k_{rf} = The contemporaneous expected yield on the risk-free asset

RP_m = The equity risk premium, which is the excess return on the market portfolio over the risk-free rate

$ß_s$ = The beta coefficient of asset s.[2]

The second step involves setting equation 2 equal to equation 3, as they represent different theoretical definitions of the same element, required rate of return or weighted average cost of capital.

$$\left[EBIT(1-T) - EVA\right]TC^{-1} = w_d k_d (1-T) + w_p k_p + w_s k_s$$

Eq.5

Redefining the weights on the right hand side of equation 5 as noted above as the market value of the relevant capital component divided by the market value of the firm's total capital employed results in equation 6.

$$\left[EBIT(1-T) - EVA\right]TC^{-1} = \frac{D}{TC} k_d (1-T) + \frac{P}{TC} k_p + \frac{S}{TC} k$$

Eq.6

Where D, P and S are the market values of the firm's long-term debt, preferred stock, and common stock respectively; and TC is the total value of the three capital components combined (e.g., D + P + S = TC). All other variables are as previously defined.

Simplifying equation 6 yields the economic value added estimate of the required yield on the firm's stock (k_s) as found in equation 7.

Eq.7

The third step in finding the EVA estimate of equity risk involves substituting, in equation 7, the capital asset

$$k_s = \left[EBIT(1-T) - EVA - Dk_d (1-T) - Pk_p\right]S^{-1}$$

pricing model definition of the required yield on the firm's stock which is found in equation 4. This yields equation 8:

$$k_{rf} + RP_m \beta_s = \left[EBIT(1-T) - EVA - Dk_d (1-T) - Pk_p\right]S^{-1}$$

Eq.8

Finally, simplifying equation 8 to isolate the equity risk factor, beta (ß), we get the EVA measure's estimate of the firm's equity beta in equation 9.

$$\beta_s = \left[\left[EBIT(1-T) - EVA - Dk_d (1-T) - Pk_p\right]S^{-1} - k_{rf}\right]RP_m^{-1}$$

Eq.9

If the EVA estimate of the firm's market risk is consistent with the historical estimate, then this *calculated* beta and the *reported* betas should be equal.

DATA AND METHODOLOGY

To test whether or not the EVA estimate of the firm's beta is consistent with calculated beta, data are collected for sample firms from Stern Stewart and Company's annual EVA scoreboard. Each firm's EVA is taken from the report, and the remaining data necessary to compute the beta coefficient is taken from the Stock Investor Pro database distributed by the American Association of Individual Investors (AAII). These data are then used to calculate the firm's beta coefficient implied by its reported EVA. This EVA-generated beta is then compared, through a paired t-test, to the firm's beta calculated using the standard methodology of regressing the stock's returns on the returns on the overall market to determine if the two measures are significantly different. If the financial markets are reasonably efficient, and if the firm's EVA fairly assesses the firm's true cost of capital, then the two betas should be statistically equal.

The data elements required to conduct this study are the firm's EBIT, Tax Rate, EVA, Market Value of Debt, Yield to Maturity on Existing Debt, Market Value of Preferred Stock, Preferred Dividend, Market Value of Common Equity, The Risk-Free Rate, and the Market Equity Risk Premium.

EBIT is the firm's fiscal year reported operating income. The market value of debt is approximated by the book value of the firm's debt at the end of fiscal year, the year in which the EVA is measured. Also, the firm's yield to maturity on debt is approximated by the average interest rate on the firm's book debt. Thus, the term Dk_d simplifies to the firm's annual interest expense. The market value of the equity is estimated by multiplying the book value of the firm's equity by its average market-to-book ratio for the year in which the EVA is measured. Also, since these are all relatively large companies, it is assumed that they are normally in the top marginal tax bracket. Therefore, this study assumes an across-the-board tax rate of 40%. To simplify the collection of data, we selected only firms that have no reported preferred equity, so Pk_p goes to zero. Finally, the risk-free rate used in this study was the one year constant maturity treasury rate that existed at the end of 2001, which was 4.81%, and the equity risk premium was estimated at the 4% long-run historical average. All data are reported as of the end of the fiscal year. This simplification procedure yields an equation for the EVA estimate of a firm's beta of:

$$\beta_s = \left[\left[EBIT\left(0.6\right) - EVA - Int\left(0.6\right)\right]S^{-1} - 0.481\right]0.4^{-1}$$

This model was applied to data over the years 1995 to 2001. The complete sample of companies in the EVA dataset totaled 1,000 companies. This sample was first reduced by eliminating any companies for which data was unavailable in the AAII database. This was only 13 companies, yielding a remaining dataset of 987 companies. The remaining data were further reduced by eliminating any companies for which complete data were unavailable for all years in the study. This resulted in a final dataset of 399 companies. Descriptive data on the firms in the final sample is presented in Table 1.

Table 1: Descriptive Data for EVA Beta vs. Historical Beta Sample

Millions (except per share)	2001	2000	1999	1998	1997	1996	1995
Average Revenues	$8,294	$7,825	$6,987	$6,192	$5,830	$5,225	$4,690
Average Net Income	$347.7	$559.6	$484.4	$445.6	$375.5	$358.6	$253.2
Average EPS	$1.14	$1.74	$1.60	$1.41	$1.39	$1.38	$1.18
Average Dividend/Share	$0.45	$0.47	$0.47	$0.47	$0.46	$0.45	$0.43
Average Assets	$10,883	$10,021	$8,624	$7,395	$6,789	$6,113	$5,440
Average Equity Book Value	$3,503	$3,140	$2,685	$2,259	$2,055	$1,872	$1,641
Average EVA	$-269.0	$-30.1	$1.0	$68.1	$36.0	$39.0	$43.5

RESULTS

Using the income statement and balance sheet items from the 399 complete records in the data set, each firm's EVA predicted beta is calculated for the years 1995 through 2001. Additionally, using data on the monthly rate of return for each company in the data set and the corresponding rate of return on the Dow Jones industrial average over the preceding three years, each firm's historical beta coefficient is calculated for the years 1995 through 2001. The difference between the EVA estimate of the firm's beta and its calculated beta is then determined for each of these years. A one-sample t-test is conducted on the calculated differences for each of the seven years in the study, first to determine if their mean values differ significantly from zero, and then to determine if any such differences persist for the duration of the study. The results from the means test are presented in Table 2 below.

Table 2: T-test For Mean Difference Between EVA Estimated Beta And Historical Regression Calculated Beta

Year	Lower CL	Mean difference	Upper CL	t-value	p-value
2001	-0.838	-0.281	0.2757	-0.99	0.3214
2000	-0.915	-0.702	-0.488	-6.47	<0.0001
1999	-1.122	-0.903	-0.683	-8.07	<0.0001
1998	-1.007	-0.767	-0.526	-6.27	<0.0001
1997	-1.356	-1.215	-1.074	-16.98	<0.0001
1996	-1.188	-1.008	-0.827	-10.97	<0.0001
1995	-1.22	-0.977	-0.734	-7.91	<0.0001

As can be seen in Table 2, there is a significant difference between the beta coefficient required to give the firm the reported EVA and the beta coefficient calculated by traditional regression analysis for all years in the study except 2001. These results also indicate that the average market calculated beta was consistently greater than the beta predicted by the EVA value. The difference was calculated by subtracting the market-generated beta from the EVA-predicted beta; all of the mean differences were negative. It is also noteworthy that with the exception of the 2001 year, the 95% two-tailed confidence intervals were also uniformly negative.

IMPLICATIONS, LIMITATIONS, AND DIRECTION FOR FUTURE RESEARCH

Given the mathematical linkage between a firm's EVA and its measure of market risk presented in this paper, the evidence seems to suggest that when calculating a firm's Economic Value Added, it is necessary to understate the firm's riskiness. This seems problematic, in that if one uses EVA as a performance measure, and correctly states the riskiness of the firm, then EVA would, on average, appear much less attractive. That is to say, the average EVA's would decline because the dollar cost of capital would be greater if risk were correctly accounted for. This does not eliminate the usefulness of EVA as a concept, because EVA does, if properly framed, encourage a firm's managers to consider that all of the activities of the firm have capital costs in addition to the operating costs that they are already predisposed to consider.

Several avenues of future research are suggested by this work. One such avenue would be to test whether the beta differentials are robust across industries. To do this, the data could be parsed into industry groups, and then the means difference test could be performed on each separate group. If the results are attenuated by industry group, then one could try to identify specific industry factors that might contribute to this difference.

The empirical examination of the theoretical construct presented in this paper is not without limitations. Generally, the limiting factors have been addressed by assumption. For example, the empirical tests presented here essentially examine the EVA model described by the equation

$$EVA = EBIT\left(1-T\right) - Dk_d - Sk_s$$

In this paper, the required dollar return on the firm's debt, Dk_d, is equated to the firm's annual interest charge. This assumes that the firm's current cost of debt does not deviate significantly from its average historical cost of debt. This assumption could be problematic if a significant deviation does exist. One avenue of future research on this theoretical construct would be to more accurately define the debt component of this model to see if the equity risk difference is robust. Additionally, the derivation of k_s which is necessary to estimate beta, assumes a constant equity risk premium. This equity risk premium was estimated using a long-term average; but if the sample data differs significantly from the long-term characteristics of the overall market, the resulting estimate of beta could be biased. Another possible avenue of future empirical research on this model would be to more precisely define the equity risk premium for the time period represented by the data, and then to test whether the beta differentials are still robust.

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END NOTES

[1]See for example Brigham and Houston *Fundamentals of Financial Management* Concise 4th edition page 371.

[2]The basic premise of Sharpe's (1964) work is that an individual investor will, given the opportunity, eliminate all risk that they can through diversification. The remaining risk that the investor cannot "diversify" away is termed market risk and is a function of risk factors that affect all securities to some degree. This market risk is captured in the way that the asset's value, and consequently its rate of return, varies with respect to the variability of all assets. The measure of market risk is known as the beta coefficient, and is calculated as the covariance between the returns of asset i and the returns of the overall market divided by the variance of the returns of the overall market.