The Search for the Best Financial Performance Measure

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Refined economic value added (REVA) provides an analytical framework for evaluating operating performance measures in the context of shareholder value creation. Economic value added (EVA) performs quite well in terms of its correlation with shareholder value creation, but REVA is a theoretically superior measure for assessing whether a firm's operating performance is adequate from the standpoint of compensating the firm's financiers for the risk to their capital. In this article, comprehensive statistical analysis of both REVA and EVA is used to estimate their correlation with and their ability to predict shareholder value creation. REVA statistically outperforms EVA in this regard. Moreover, the realized returns for the 1988–92 period for the top 25 REVA firms were higher than the realized returns for the top 25 EVA firms.

In the 1980s, shareholder activism reached unprecedented levels and led to increased pressure on firms to maximize shareholder value consistently. For example, *Time* magazine summarized this activism as "Angry investors closed out the Decade of Greed with demands that executive compensation should be tied to company performance" (Smolowe 1996). The basic idea is that if managers are offered compensation contracts that are tied to shareholder wealth changes, their incentives will be better aligned with those of shareholders than is the case for other types of contracts. In designing such contracts, however, an important issue is which measure of shareholder performance to use in designing the contract.

The obvious metric for judging firm performance is the stock price itself (see, e.g., Jensen and Murphy 1990 and Milbourn 1996). Stock price, however (or returns based on stock price), may not be an efficient contracting parameter because it is driven by many factors beyond the control of the firm's executives.[1] Moreover, as one moves down the organizational ranks, the inefficiencies of stock-based compensation as a means of aligning managerial interests with those of stockholders become even more evident because managers at lower levels have even less impact on the stock price than the CEO. Tying managerial compensation to stock price may impose excessive risk on managers and may detract from the ability of such compensation to provide incentive for managers to maximize shareholder wealth.

Any financial performance measure used in managerial compensation, on the one hand, must be correlated highly with changes in shareholder wealth and, on the other, should not be subject to all of the randomness and "noise" inherent in a firm's stock price. This dichotomy is the fundamental tension a good performance measure must resolve. A recent example of a performance measure that seeks to resolve this tension is economic value added (EVA). This measure, proposed by Stern Stewart Management Services, creatively links the firm's accounting data to its stock market performance (Stewart 1991).

Before examining the correlation between shareholder wealth and a performance measure, one must first define the appropriate way to measure changes in shareholder wealth. We contend that shareholders are concerned with the *abnormal* return they earn in any period—that is, the return they earn in excess of what they *expected* to earn for a firm within a given systematic risk class. When this return is positive, shareholders have more than covered their risk-adjusted opportunity cost of providing their capital. Conversely, when this return is negative, they have been inadequately compensated for risk.[2] Given this relationship, a good financial performance measure should correlate highly with abnormal stock returns.

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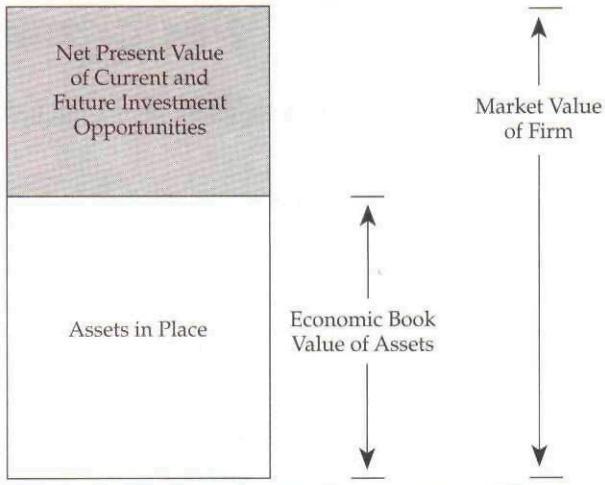
In this article, we present an empirical analysis of the ability of EVA to predict abnormal return and of the contemporaneous correlation between EVA and abnormal return. In addition, we define a new performance measure, a refinement of EVA, and examine its statistical properties. This new performance measure, refined economic value added (REVA), complements EVA in that it could be used in conjunction with EVA, with the choice of measure dictated by the level of the organization at which the performance measure is used. We argue that REVA is a better measure of performance for top management, although EVA may be useful at lower levels. Our empirical tests are extensive, and we also focus on nonparametric tests of the predictive abilities of EVA and REVA.

Although many companies use EVA for both resource allocation and compensation purposes, virtually no research reported in the published literature provides information about the statistical relationship of EVA to shareholder value.[3] One goal of this article is to fill that void. Moreover, much remains to be learned about alternatives and complements to EVA, particularly for managers at different levels of an organization. Although our efforts in this direction are by no means exhaustive, we hope that the introduction of REVA is a useful first step.

STRATEGY, VALUE, AND THE CHOICE OF PERFORMANCE MEASURE

An appropriate performance measure gauges how management strategy affects shareholder value as measured by the risk-adjusted return on invested capital. An appropriate performance measure to gauge the effectiveness of a given strategy must, therefore, incorporate the required rate of return on invested capital, accurately measure the amount of capital used by the company, and correlate highly with the risk-adjusted rate of return earned by shareholders. In this section, we formalize how invested capital and the required rate of return on that capital should be measured, as well as what is meant by an appropriate risk-adjusted return to shareholders.

Figure 1. The Components of Value



Invested Capital, Strategy and Value

Figure 1 illustrates the components of firm value. The most transparent component of a firm's value is its physical assets in place: plant and equipment, real estate, working capital, and so forth. Another component is the net present value of the firm's current and future investment opportunities. This component's value is less tangible than its physical assets, is driven significantly by the firm's strategy, and is sizable for many firms. The total value of the firm is the sum of these two components of value. The question is: How do we determine these values?

The firm's balance sheet contains one measure of the value of the firm's assets in place. Consider the accounting-based balance sheet in Table 1, for example. Because of a variety of accounting distortions, the total asset value on the typical balance sheet does not accurately represent either the liquidation value or the replacement-cost value of the assets in place. Therefore, it is of limited use for asset valuation purposes and must be transformed.

The proponents of EVA, most notably Stern Stewart, are careful to adjust this accounting balance sheet before arriving at an estimate of the value of the firm's assets in place.[4] The adjustments include netting the non-interest-bearing current liabilities against the current assets, adding back to

Table 1. Accounting-Based Balance Sheet

Assets	*Liabilities and Net Worth*
Current assets	Non-interest-bearing current liabilities (NIBCLs)
Net goodwill	Interest-bearing current liabilities (IBCLs)
Fixed assets	Long-term debt
	Equity (net of write-offs)
Total assets	Total liabilities and net worth

equity the gross goodwill (i.e., adding cumulative amortized goodwill back to total assets), restructuring and other write-offs, capitalized value of R&D (and possibly advertising), LIFO reserve, and so forth. The debt balance is increased by the capitalized value of operating lease payments. The goal is to produce an adjusted balance sheet that reflects the economic values of assets in place more accurately than the inherently conservative, historical-cost-based balance sheet guided by generally accepted accounting principles.

After these adjustments, the typical firm's "economic book value" balance sheet would look as it does in Table 2. Although this economic book value balance sheet represents the value of the assets in place more accurately than the balance sheet produced by the firm's accountants, it still does not determine the total value of the firm, which includes the value of future opportunities.

The total value of the firm—the sum of the two components of value in Figure 1—is also equal to the market value of equity plus the market value of debt. Thus, the difference between the market value of the firm and the economic book value of its assets in place represents the market's assessment of the value of the firm's current and future investment opportunities. This difference can be considered an assessment of the value of the firm's competitive strategy and its deployment of human resources. If we recast the firm's balance sheet in market value terms, we have a balance sheet such as that presented in Table 3.[5]

The market value of assets can be either above or below the economic book value of the assets in place. In particular, if the firm executes a poor strategy in the opinion of the market or if it does not possess the human resources needed to implement a good strategy successfully, the market will lower the value of the firm's assets, perhaps below the economic book value of the assets in place.

How Much Capital Is Invested in the Firm?

A good financial performance measure should ask how well the firm has generated operating profits, given the amount of capital invested to produce those profits. The idea is that the firm's financiers are free to liquidate their investment in the firm and invest the liberated capital elsewhere. Thus, the financiers must earn at least their opportunity cost of capital on the invested capital. This condition implies that this cost of capital must be subtracted from operating profits to gauge the firm's financial performance. EVA, for that reason, defines net operating profit after tax (NOPAT) and subtracts a capital charge for the economic book value of assets in place. The economic book value of assets in place is the measure of the capital provided to the firm by its financiers. But does this amount truly represent the capital used to generate the operating profit?

We believe the answer to that question is negative. At the beginning of any period, the financiers as a group could sell the entire firm for its market value. They could then invest their proceeds in assets identical in risk to the firm and earn an expected return equal to the firm's weighted-average cost of capital (WACC).[6] By not liquidating their holdings in the firm, these financiers are forgoing this opportunity to earn the weighted-average cost of capital on the market value of the firm at the beginning of the period.

For the firm to create a true "operating" surplus for its financiers in a given period, its operating profit at the end of the period must exceed a capital charge that is based on the total market value of the capital used at the beginning of the period, not simply the economic book value of its assets in place. The capital commitment of the firm's financiers is represented by the total market value of the firm, not simply the economic book value of the

Table 2. Economic Book Value Balance Sheet

Assets	*Liabilities and Net Worth*
Current assets (with inventory at FIFO)—NIBCLs	IBCLs
Gross goodwill	Debt (+ capitalized leases)
Fixed assets	Equity (+ adjustments for deferred taxes, goodwill amortization, write-offs, LIFO reserves, etc.)
Economic book value of assets in place	Total liabilities and net worth

Table 3. Market-Value-Based Balance Sheet

Assets	*Liabilities and Net Worth*
Market value of assets	Market value of debt (including leases)
	Market value of equity
Total market value of assets	Total market value of debt and equity

assets in place. This "investment" in the firm in any given period constitutes the capital that the firm has used to produce profits. This perspective motivates our development of REVA in the next section.

Operating versus Trading-Based Performance

Measures of shareholder wealth creation focus on the firm's *stock price* performance and seek to determine how much shareholders increase their wealth from one period to the next based on the dividends they receive and the appreciation in the firm's stock price. Essentially, such trading-based performance measures assess how well an investor would have done if he or she had purchased a share of stock at the beginning of the period and sold it at the end. This type of measure of shareholder wealth creation is called a trading-based measure of performance. In contrast, performance measures such as EVA focus on the firm's operating performance from the standpoint of its financiers.

An operating measure of current performance focuses solely on the performance of the firm in a given period; a trading-based measure of performance captures revisions in the market's beliefs about the firms's entire future stream of operating performances. If stock markets are efficient and we examine a sufficiently long time horizon, these two measures will converge. We usually assess performance over shorter horizons, however: a year, a quarter, or a month. Therefore, any operating measure of performance will diverge somewhat from a trading-based measure of performance. Obviously, we do not want to use a trading-based measure of performance for compensating all of our managers, particularly those at lower levels of the organization, whose decisions have less impact on stock price. We do, however, want a measure of performance to be a barometer of shareholder wealth creation against which we can judge the efficiency of any operating performance measures.

Shareholders can earn a return on their investment in two ways: through dividends and through capital gains. Over any period of time, t, the shareholder return for firm j can be specified as

$$R_{j,t} = \frac{D_{j,t} + (P_{j,t} - P_{j,t-1})}{P_{j,t-1}},$$

where $D_{j,t}$ is the dividends paid during the period $t-1$ to t and $P_{j,t}$ is the price of the shares at the end of period t.

Many factors influence $R_{j,t}$, most notably, the risk of the investment, the interest rates prevailing in the capital markets, and the expertise of the firm's managers. The capital asset pricing model (CAPM) captures the first two factors by specifying that the expected return on a stock investment is

$$E(R_{j,t}) = Rf_t + \beta_j[E(Rm_t) - R_{f_t}],$$

where

R_{f_t} = the risk-free bond yield at time t

β_j = firm j's beta, a measure of the firm's systematic risk

$E(Rm_t) - R_{f_t}$ = the expected equity market risk premium, usually taken as the long-run, average realized return on the market in excess of risk-free bond returns

The CAPM thus helps to determine the abnormal return firm j earned in period t. We call this return alpha and calculate it as

$$\alpha_{j,t} = R_{j,t} - E(R_{j,t}).$$

Thus, $\alpha_{j,t}$ measures the *actual* shareholder return in excess of the return that was expected in a period, given the firm's systematic risk. In that sense, the return is abnormal. Alpha, we propose, is thus the appropriate measure of shareholder wealth creation in any given period. Consequently, alternative operating performance measures will be judged by their correlation with this abnormal return.

This measure is indeed a high hurdle for performance. One would not expect a large number of firms to achieve positive abnormal returns for many periods. In fact, because a firm with a string of positive alphas is one that continues to produce shareholder returns in excess of the risk-adjusted expected return, this firm is consistently "beating market expectations." Firms that perform this well are truly exceptional and quite rare. The question, then, is: What operating measure of performance correlates highly with this measure of shareholder wealth creation?

REVA AS A HIGH-LEVEL PERFORMANCE MEASURE

The operating measure of performance should obviously capture how well a given company has performed in terms of operating income. Net operating profit after taxes alone, however, is not an appropriate measure because it neither captures how much capital is used to generate a given level of income nor accounts for the required rate of return on invested capital. Thus, an appropriate performance measure is one that includes net operating income after taxes, the amount of capital invested, and the required rate of return on capital.

What Is REVA?

EVA is defined as

$$\text{EVA} = \text{NOPAT} - k_W(NA), \tag{1}$$

where k_W is the weighted-average cost of capital and NA is defined as adjusted book value of net capital at the beginning of the period.

In Equation 1, NOPAT is defined as reported net operating profits plus any increase in bad debt reserve plus any increase in the LIFO reserve plus amortization of goodwill plus any increase in net capitalized R&D plus other operating income (including passive investment income) minus cash operating taxes.

A firm's weighted-average cost of capital in Equation 1 (WACC $\equiv k_W$) is derived from the following formula:

$$k_W = \frac{D_M}{D_M + E_M} k_D(1-T) + \frac{E_M}{D_M + E_M} k_E, \tag{2}$$

where

D_M = market value of the firm's total debt

E_M = market value of the firm's total equity

k_D = pretax cost of debt

T = the firm's marginal tax rate

k_E = cost of equity

A firm's net asset base in Equation 1 is defined by a company's total assets minus non-interest-bearing current liabilities, with the adjustments discussed earlier. That is, net assets represent the total economic book value of the firm's assets in place.

The motivation for the REVA refinement to EVA stems partly from EVA's use of the economic book value of assets when the capital charge for the firm is derived from a market-based WACC. To make inferences about changes in shareholder wealth, a market-derived cost of capital should be applied to the market value of the firm's assets. Thus, the REVA for a given period t is defined as

$$\text{REVA}_t = \text{NOPAT}_t - k_W(\text{MV}_{t-1}), \tag{3}$$

where NOPAT_t is the firm's NOPAT at the end of period t and MV_{t-1} is the total market value of the firm's assets at the end of period $t-1$ (beginning of period t). MV_{t-1} is given by the market value of the firm's equity plus the book value of the firm's total debt less non-interest-bearing current liabilities, all at the end of period $t-1$.

EVA and REVA Compared

The key distinction between EVA and REVA is that REVA assesses its capital charge for period t on the *market value* of the firm at the end of period $t-1$ (or the beginning of period t) rather than on the economic book value of the assets in place.

The following example highlights the potential differences in the shareholder wealth implications of EVA and REVA. Suppose an investor holds one share of XYZ Company stock at the beginning of the year. The stock is currently trading at $50 a share, and the economic book value of the stock is $40 a share.[7] Suppose that the investor and the rest of the market expect this stock to earn 10 percent over the next year. The investor expects this 10 percent return on the $50 *market* value of the firm, not its $40 economic book value. That is, the investor expects a payoff of $5 a share, *not* $4. The contrast between EVA and REVA can now be seen in this context. Suppose the firm is completely equity financed. With all-equity financing, the WACC for this firm is simply its cost of equity of 10 percent. Further assume that the firm has 100 shares of stock outstanding at the beginning of the year (period $t = 0$). Therefore, the economic book value of the firm is 100 times $40, or $4,000, and the market value of the firm is 100 times $50, or $5,000, at $t = 0$. If during the year the firm generates a NOPAT of $450 on the firm's invested capital, how has the firm done in terms of EVA and REVA?

The firm has generated an EVA at time $t = 1$ of

$$\begin{aligned}\text{EVA}_1 &= \text{NOPAT}_1 - (\$4{,}000 \times 10\%)\\ &= \$450 - \$400\\ &= \$50.\end{aligned}$$

According to the EVA perspective, this firm has created $50 of value for its shareholders. Now, consider the firm's REVA:

$$\begin{aligned}\text{REVA}_1 &= \text{NOPAT}_1 - (\$5{,}000 \times 10\%)\\ &= \$450 - \$500\\ &= -\$50.\end{aligned}$$

According to REVA, this firm has destroyed $50 in shareholder value.

Should the firm's management be satisfied with its performance over this period? It has generated a *positive* EVA and a *negative* REVA. The firm, with a cost of capital of 10 percent, has produced an 8 percent return on the market value of its assets and an 11.25 percent return on the economic book value of its assets. Because an investor in this firm could have taken his or her $50 a share and invested it in another company of equivalent risk to generate the 10 percent required return, the NOPAT of 8 percent of the market value of the firm is, in our view, inadequate compensation.

This example, although simple, illustrates how a firm could be delivering less in terms of operating earnings than the shareholders require and yet appear to be creating shareholder value based on

EVA. This possibility is the first justification for using REVA.

Flows to Equity versus Total Flows to All Financiers

Another difficulty with EVA provides a second justification for using REVA. Conceptually, EVA should be the same regardless of whether we use NOPAT and the WACC or (adjusted) net income and the equity cost of capital.[8] However, as we show below, there is no such equivalence when the market value of a firm differs from its book value.

The flows to equity-based EVA are defined as

$$\text{EVA}_t(\text{Equity flows}) = \text{Net income}_t - k_E(E),$$

where net income is simply the NOPAT less the firm's after-tax interest expense and E is the economic book value of equity. We can then write

$$\text{Net income}_t = \text{NOPAT}_t - k_D(1 - T)D,$$

where D is the economic book value of debt. Therefore, we should have

$$\text{EVA}_t(\text{NOPAT}) = \text{EVA}_t(\text{Equity flows}). \quad (4)$$

Expanding both the left hand side and the right hand side of Equation 4 yields

$$\text{NOPAT}_t - k_W(NA_{t-1}) = \text{Net income} - k_E(E). \quad (5)$$

Dropping the time subscripts and recognizing that Net income = NOPAT – $k_D(1 - T)D$, we can write Equation 5 as

$$\text{NOPAT}_t - k_D\left\{(1-T)\left[\frac{D_M}{(D_M + E_M)}\right](D+E)\right\}$$
$$- k_E\left[\frac{E_M}{(D_M + E_M)}(D+E)\right]$$
$$= \text{Net income} - k_D(1-T)D - k_E(E).$$

Therefore, for the equivalence to hold, D_M must equal D and E_M must equal E. That is, the market values of debt and equity should be equal to the respective economic book values. It is uncommon for the market value of equity to be precisely equal to the economic book value of equity, primarily because market value includes an estimate of the value of future opportunities. This conceptual difficulty does not exist with REVA, primarily because it relies on the market value of capital.

We can thus summarize two key advantages of REVA relative to EVA. First, whenever REVA is positive, incremental shareholder value has been created. The operating income flowing to financiers at the end of the period as a percentage of the market value of their investment at the beginning of the period exceeds their opportunity cost of capital. This condition does not hold for EVA—the financiers could be receiving an operating-income-based return that is less than their opportunity cost of capital even when EVA is positive. Second, REVA can be computed based on total operating flows to debt and equity or only on the flows to equity. This capability is true for EVA only when the market values of debt and equity coincide with their respective economic book values.

Organization Level and Choice of Financial Measure

REVA is a more appropriate performance measure than EVA when considering the shareholders' view of the firm. Hence, the senior executives in the firm (e.g., the CEO and other members of the executive committee) should be evaluated on the basis of the firm's REVA performance. The firm's value derives both from its physical assets in place and its strategy with respect to future opportunities. Both of these values are the appropriate domain of the firm's senior executives. The market value of the firm—which is a component in REVA—includes the values of both the physical assets and the strategy, whereas the economic value of the firm—which is a component in EVA—represents only the values of the physical assets in place. Strategy is the primary responsibility of top management. The firm's economic value is an adequate representation of invested capital from the standpoint of those below top management. Thus, REVA could be used to compensate senior management and EVA could be used to compensate divisional managers and those below them.

EMPIRICAL ANALYSIS

The empirical analysis used the Stern Stewart Performance 1000 database for the years 1982 through 1992. We randomly selected 600 of the 1,000 firms in the database and proceeded to calculate each firm's EVA, REVA, total shareholder return, and risk-adjusted abnormal return for each year. These calculations involved matching the 600 firms to corporate financial data for those years. All accounting and financial market data were taken from Standard & Poor's Compustat and the University of Chicago's CRSP databases, respectively.

Calculating a firm's yearly EVA and REVA requires estimates of its NOPAT, WACC, economic book value of assets, and market value of assets. In our calculation of REVA, we used the NOPAT data provided by the Stern Stewart database. The market value of capital was estimated by summing the market value of equity, book value of interest-bearing

liabilities, and book value of preferred stock.[9] Book values were used for debt and preferred stock because market values for these variables are not available.[10] The WACC was estimated as the weighted average of the cost of equity, debt, and preferred stock, where the weights are the market-based capital structure weights obtained from the capital structure components. To estimate the firm's cost of debt, we assigned the bond yield as reported in Standard & Poor's Industrial Bond Guide for commensurate bond ratings. The after-tax cost of debt was estimated by multiplying the firm's cost of debt by its marginal tax rate, which was estimated by dividing the reported tax expense by the firm's pretax income. The cost of equity was estimated using the CAPM.[11] The cost of preferred stock was estimated as the average of the cost of equity and debt.

To determine the cost of equity, estimates of the risk-free rate, the expected market risk premium, and the firm's beta are needed. The yield to maturity of a one-year discount bond taken from the CRSP Fama–Bliss files was used as a proxy for the risk-free rate. To gauge the expected market risk premium, historical averages of realized annual market risk premiums from 1926 to the year prior to the observation year were calculated. The realized market risk premiums were taken from Ibbotson Associates, *1995 Yearbook of Stocks, Bonds, Bills, and Inflation*.[12] Firm betas were calculated using the methodology outlined by Fama and French (1992). This methodology involves first assigning all NYSE, Amex, and Nasdaq firms available on CRSP to 10 size-based portfolios. Each size portfolio is then portioned into 10 beta portfolios. The monthly returns of each of the 100 equally weighted portfolios were used to estimate the portfolios' betas using the techniques outlined by Dimson (1979).[13] The portfolio beta was assigned to each firm within its portfolio and used to calculate the firm's cost of equity.

EVA was estimated using NOPAT and the economic book values of capital from Stern Stewart, and the WACC used to calculate REVA was also used to re-estimate EVA. This step was to isolate the true difference between REVA and EVA—that is, the different capital bases. Using different WACCs could provide results driven solely by the method used to estimate WACC and, as a result, would cloud the true underlying relationship between the variables in question.[14]

Empirical Results

How well do EVA and REVA correlate with shareholder wealth creation? The first set of tests involved regressing the CAPM-based abnormal returns of each security on various combinations of EVA and REVA measures to determine how well each performance measure explains abnormal returns—that is, returns over and above the expected return. Both EVA and REVA were scaled by the market value of equity to create two new variables, EVARET and REVARET. This step was done to make both variables consistent with the abnormal return variable, which was measured as a percentage. The market value of equity was used because both EVA and REVA gauge the value creation for shareholders. First, we regressed abnormal returns on EVARET and REVARET individually. Our results indicate that, on an individual basis, both EVARET and REVARET are *positively* related to abnormal returns at the 1 percent significance level (see Table 4). A 1 percent increase in EVARET results in a 0.27 percent increase in abnormal returns. Similarly, a 1 percent increase in REVARET leads to a 0.58 percent increase in abnormal returns. Therefore, on average, an increase in either EVA or REVA leads to an increase in shareholder wealth.

What about past EVA and REVA as predictors of future abnormal returns? Our next set of tests involved adding lagged values of EVARET and REVARET into the abnormal returns regressions. These tests examined whether past realizations of EVA and REVA have a significant effect on abnormal returns. In the regression of abnormal returns on EVARET and lagged EVARET, EVARET is significantly positively related to abnormal returns and lagged EVARET is significantly *negatively* related to abnormal returns (see Table 5). In a multiple regression framework, the coefficient on lagged EVARET represents the sensitivity of abnormal returns to changes in lagged EVARET, which are uncorrelated with contemporaneous EVARET. Similarly, the coefficient on EVARET measures the sensitivity of abnormal returns to changes in EVARET, which are uncorrelated with last period's EVARET. Thus, the coefficient on EVARET represents how abnormal

Table 4. Abnormal Returns as Explained by EVARET and REVARET
(*t*-statistics in parentheses)

Coefficient	EVARET	REVARET
Intercept	0.12047	0.16232
	(16.683)**	(19.366)**
Abnormal return	0.26620	0.57997
	(5.942)**	(11.212)**
R^2	0.0114	0.0393

Note: Sample size = 3,076.

**Significant at the 1 percent level.

Table 5. Abnormal Returns on Contemporaneous and Lagged EVARET and REVARET
(*t*-statistics in parentheses)

	EVARET		REVARET	
Coefficient	Current	Lagged	Current	Lagged
Intercept	0.11969		0.16549	
	(15.357)**		(16.138)**	
Abnormal return	0.47639	–0.12918	0.75111	–0.10277
	(6.555)**	(–1.819)*	(9.588)**	(–1.408)
R^2	0.0205		0.0396	

Note: Sample size = 2,574.

*Significant at the 10 percent level.
**Significant at the 1 percent level.

returns vary with *unexpected* changes in EVA, where expectations are based on the previous period's EVA. The results above are consistent if one assumes that the market uses EVA not only to assess abnormal returns this period but also to predict future performance. If the firm has a large EVA this period, the market may revise its valuation of the firm upward significantly, reflecting revised expectations about future profitability. If the market's beliefs are not confirmed in the next period, however, the value of the stock could fall. Thus, even if a firm has a positive EVA this period, the stock may not earn positive abnormal returns.

The first key implication of this analysis is that the market appears to reward *unexpected* increases in EVA and bases expectations of future profitability on this period's EVA. The second key implication is that EVA may be inappropriate to use as a compensation measure for top management because the market is really rewarding only the *unexpected* portion of EVA. Basing compensation on total EVA may result in rewarding managers for subpar performance.

A similar regression was run using REVARET and lagged REVARET. The coefficient on contemporaneous REVARET is again significant, although lagged REVARET is insignificant (see Table 5). This result highlights a key empirical difference between REVA and EVA. REVA is positively related to abnormal returns, but any revaluation based on past period's REVA is impounded into contemporaneous REVA directly; this result occurs because REVA is a function of the market value of equity. A positive REVA in a given period that leads to revisions in the market's expectations regarding future performance will "raise the hurdle" by increasing the market value of equity and, as a consequence, next period's capital charge. Thus, REVA is a more appropriate compensation measure because it is a truer measure of whether the firm has surpassed the market's expectation and thereby added shareholder value.

We also regressed abnormal returns on EVARET and REVARET simultaneously. The purpose of such a regression was to determine which performance measure does better in explaining a firm's abnormal returns when the impact of the other measure is accounted for. The coefficient on REVARET is again significantly positive; the EVARET coefficient is now significantly *negative* (see Table 6). This result indicates that REVA contains information not captured in EVA that is relevant for predicting abnormal returns and that increases in EVA that are uncorrelated with changes in REVA result in significantly *lower* abnormal returns.

Table 6. Abnormal Returns as Explained by Both EVARET and REVARET
(*t*-statistics in parentheses)

Coefficient	EVARET	REVARET
Intercept	0.16746	
	(19.642)**	
Abnormal return	–0.20407	0.75450
	(–3.162)**	(9.981)**
R^2	0.0424	

Note: Sample size = 3,076.

**Significant at the 1 percent level.

In summary, EVA is significantly related to abnormal returns. As shown in Table 6, however, the information provided by REVA subsumes the information implied by EVA realizations. Therefore, consistent with the theory, REVA better explains changes in shareholder wealth and also management performance at the top level of the firm.[15]

Nonlinear Relationships Estimation

How often does a positive REVA (EVA) predict a positive excess return? One potential problem with the regression analysis is that both REVARET and EVARET may be related to abnormal returns in a highly nonlinear manner. An additional methodology was used to account for any nonlinearities: nonparametric tests to capture how well REVA and EVA predict the *sign* of the abnormal returns. This approach is equivalent to calculating the probability that given that a firm has a positive EVA (or REVA), the firm generates a positive abnormal return.

Our test involved splitting the sample into two groups: those with positive EVA and those with zero or negative EVA. The proportion of observations in each group that had positive abnormal returns was then calculated. If EVA is a good predictor of abnormal returns, the proportion of firms that experienced positive abnormal returns in the positive EVA subsample should exceed the proportion of firms that experienced positive abnormal returns in the negative EVA subsample. In other words, *Prob(abnormal return > 0, given that EVA > 0)* should be greater than *Prob(abnormal return > 0 given that EVA < 0)*. We found that 68.05 percent of the positive EVA sample exhibited positive abnormal returns whereas only 56.01 percent of the negative EVA sample exhibited positive abnormal returns. This procedure was repeated using REVA. Positive REVA implied a positive abnormal return 77.22 percent of the time; a negative REVA implied a positive abnormal return only 58.48 percent of the time.[16]

These results indicate that the proportion of positive REVA that correspond to positive abnormal returns is significantly higher than the same proportion for EVA.[17] Thus, although EVA on its own predicts abnormal returns fairly well, REVA performs significantly better.[18] This finding is important because senior management should seek a performance measure with the greatest ability to predict correctly directional changes in shareholder wealth. Our results imply that REVA serves both of these roles, as displayed in Table 6 and in the nonparametric tests.

How do REVA and EVA stock portfolios perform? Our extensive empirical tests document that EVA on its own can predict changes in shareholder wealth. The simpler measure, REVA, goes even farther, however. REVA appears to include all information relevant to a firm's abnormal return that is contained in EVA. Moreover, the statistical power of REVA holds up over long time horizons and out-of-sample tests. We formed three portfolios of stocks from our sample on the basis of the top 25 EVA firms over the 1982–87 period, the top 25 REVA firms over the same period, and a value-weighted market index for the same period. We then examined the total portfolio return over the 1988–92 time period. The results of this process, shown in Table 7, document that the high-performance REVA firms outperformed both the high-performance EVA firms and the market index.

CONCLUSION

This analytical framework for evaluating operating performance measures in the context of shareholder value creation indicates that the most appropriate measure of shareholder value is the return shareholders earn through price appreciation and dividends in excess of that required to compensate shareholders for systematic risk. We conclude that EVA does quite well in terms of its correlation with this measure of shareholder value creation.

EVA, however, views the economic book value of the physical assets in place as the capital financiers commit to the firm. We propose that a more appropriate measure of the capital used in the firm for any period of time is the market value of the firm at the beginning of the period. This approach led us to a refinement of the EVA measure, REVA. REVA assesses a capital charge for a period equal to the weighted-average cost of capital times the market value of the firm at the beginning of the period. This premise permits computation of REVA using either flows to equity or flows to all financiers, which is not possible with EVA unless market and economic book values happen to be equal by chance.

We conducted a comprehensive statistical analysis of both EVA and REVA to estimate their correlation with and ability to predict shareholder value creation. REVA statistically outperforms EVA in this regard. Moreover, the realized returns for the top 25 REVA firms were higher than the realized

Table 7. Portfolio Analysis of EVA and REVA (percentages)

Portfolio	Total 1988–92 Portfolio Return
Top 25 EVA firms (1982–87)	15.804%
Top 25 REVA firms (1982–87)	17.013
Value-weighted market index	12.861

returns for the top 25 EVA firms for the 1988–92 period. We concluded that REVA could be used to compensate senior executives and EVA could be used to compensate those at lower levels in an organization. Future research in this area should address the important issues of optimal compensation design using both EVA and REVA for firms of hierarchical organizational design.[19]

NOTES

1. Noise trading, portfolio insurance, and other factors unrelated to the firm's performance may induce randomness in stock prices. See Milbourn (1996) for a theoretical and empirical examination of some of these issues.
2. The theoretical statistical expectation of the abnormal return is zero.
3. Articles in the popular press have mentioned the correlation of EVA to measures of shareholder value, but the underlying research has not been reported.
4. Stern Stewart considers more than 250 accounting adjustments in moving to EVA. In practice, however, most firms find that no more than 15 adjustments are of material significance.
5. For nonpublicly traded firms or divisions, a typical ratio of market value to book value for comparable firms could be used to convert existing book values into market values.
6. That is, the firm's weighted-average cost of capital is defined as the financiers' opportunity cost of capital.
7. This disparity between economic book value and market value is representative of the sample of firms used in our subsequent empirical analysis. Specifically, we document an average ratio of adjusted economic book value to market value to be 78.19 percent.
8. Finance companies, for example, may find it appropriate to use this flows-to-equity approach.
9. As recommended in the calculation of EVA and as we define REVA in Equation 3, we did not include a firm's non-interest-bearing current liabilities.
10. Following most finance researchers, we assumed that the book values of debt and preferred stock approximate market values.
11. See Sharpe (1964).
12. See Ibbotson (1995).
13. As in Fama and French (1992), we estimated beta as the sum of the slope coefficients in a regression of portfolio returns on the contemporaneous market return and one-period lagged market return.
14. We chose to re-estimate the WACC for each firm each year because the WACCs reported in the Stern Stewart Performance 1000 are based on rolling three-year averages.
15. Because beginning-period market value of equity appears in the denominator of both the independent and dependent variables, the independent and dependent variables may be spuriously correlated. As a result, one might find a significant relationship between the independent variables and abnormal returns even if the underlying variables are uncorrelated. Because the market value of equity undergoes a nonlinear transformation, however, the spurious correlation should be reduced. To control for any residual spurious correlation, we ran instrumental variable regressions in which the lagged values of EVARET and REVARET were used as instruments. The conclusions drawn from the instrumental variable regressions were qualitatively the same as those drawn from the ordinary least squares regressions.
16. Both of these differences are significant at the 1 percent level.
17. This difference is significant at the 1 percent level.
18. These nonparametric results fortify our intuition that a firm could have a positive EVA and still be destroying shareholder value.
19. We would like to thank W. Van Harlow III for his helpful comments on an earlier draft of this article.

REFERENCES

Dimson, Elroy. 1979. "Risk Measurement When Shares Are Subject to Infrequent Trading." *Journal of Financial Economics*, vol. 7, no. 2 (June):197–226.

Fama, Eugene F., and Kenneth R. French. 1992. "The Cross-Section of Expected Returns." *Journal of Finance*, vol. 47, no. 2 (June):427–65.

Ibbotson Associates. 1995. *1995 Yearbook of Stocks, Bonds, Bills, and Inflation*. Chicago: Ibbotson Associates.

Jensen, Michael, and Kevin Murphy. 1990. "Performance Pay and Top-Management Incentives." *Journal of Political Economy*, vol. 98, no. 2 (April):225–62.

Milbourn, Todd T. 1996. "The Executive Compensation Puzzle: Theory and Evidence." IFA Working Paper No. 235, London Business School.

Sharpe, William F. 1964. "Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk." *Journal of Finance*, vol. 19, no. 3 (July):425–42.

Smolowe, Jill. 1996. "Reap as Ye Shall Sow." *Time*, vol. 147, no. 6 (February 5):45.

Stewart, G. Bennett III. 1991. *The Quest for Value*. New York: Harper Business