



# Shareholder Value Advisors

## ***Measuring the Incentive Efficiency of Relative Performance Plans***

***By Steve O'Byrne  
President  
Shareholder Value Advisors***

The wealth leverage of the relative performance option by itself (2.23) is greater than the wealth leverage of the conventional option (1.93) or restricted stock (1.00), but the wealth leverage of the relative performance option pay package is much less than the wealth leverage of the conventional option or restricted stock pay package. The wealth leverage of a pay package with cash and an equity incentive is equal to the weighted average of the wealth leverage of cash and the wealth leverage of the equity incentive. Since the wealth leverage of cash is zero, the wealth leverage of the pay package can be calculated as the wealth leverage of the equity incentive multiplied by the percentage of executive value provided by the equity incentive. The wealth leverage of the relative performance option is only 0.509 =  $(.151/.664) * 2.23$  because the option only represents 23% of the pay package executive value.

### ***Calculation of the Value to the Executive***

To estimate the value of a conventional option to an undiversified executive, we first need to estimate the value of the underlying stock to the executive. Similarly, to estimate the value of the relative performance option to an undiversified executive, we first need to estimate the value of the underlying market indexed stock to the executive.

The value of the stock to an undiversified executive depends on the difference between the risk premium for the total risk of the stock and the risk premium for the market risk of the stock. The following table shows the calculations for the average company:

A	Stock Total Risk (i.e., stock volatility)	0.441
B	Stock Correlation With Market Return	0.380
C	Stock Market Related Risk (= A * B)	0.168
	Market Risk Premium (Annual)	5.00%
D	MRP (Continuously Compounded)	4.88%
E	Market Total Risk (i.e., S&P 500 volatility)	0.191
F	Market Price of Risk (= D/E)	0.255
G	Stock Market Risk Premium (= C * F)	0.043
H	Stock Total Risk Premium (= A * F)	0.112
I	Risk Premium for Undiversified Executive (= H - G)	0.070
J	Undiversified Discount Factor for Each Year of Holding (continuously compounded = $\exp(-I)$ )	0.933

For the six year holding period used in our example above, the total undiversified discount factor is .659 (=  $.933^6$ ). Thus, stock with a company cost of \$0.983 has an executive value of \$0.647 (=  $\$0.983 * .659$ ).

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### ***Calculation of the Value to the Executive – cont'd***

The value of the market indexed stock also depends on the difference between the risk premium for the total risk of the stock and the risk premium for the market risk of the stock. The total risk of the market indexed stock can be calculated from the stock's risk and correlation with the market. The market risk of the market indexed stock is, of course, zero. The following table shows the calculations for the average company:

A	Stock Total Risk	0.441
B	Stock Correlation With Market Return	0.380
C	Risk of Market Indexed Stock ( $= A * ((1-(B*B))^{.5})$ )	0.408
D	Market Correlation of Market Indexed Stock	0.000
E	Market Related Risk of Market Indexed Stock ( $= C * D$ )	0.000
F	Market Price of Risk	0.255
G	Market Risk Premium of Market Indexed Stock ( $= E * F$ )	0.000
H	Total Risk Premium of Market Indexed Stock ( $= C * F$ )	0.104
I	Risk Premium for Undiversified Executive ( $= H - G$ )	0.104
J	Undiversified Discount Factor for Each Year of Holding (continuously compounded $= \exp(-I)$ )	0.901

For the six year holding period used in our example above, the total undiversified discount factor is .535 ( $= .901^6$ ). Thus, market indexed stock with a company cost of \$0.983 would have an executive value of \$0.526 ( $= \$0.983 * .535$ ), or 19% less than the executive value of ordinary stock with a company cost of \$0.983. While the executive value of market indexed stock is not shown in the pay package table above, it is, as we see below, a key input in estimating the executive value of an option on the market indexed stock.

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### *Calculation of the Value to the Executive – cont'd*

Lisa Muelbroek, in two excellent papers cited below, shows that the executive value of an option can be calculated using the Black-Scholes model and the executive value of the stock (or market indexed stock). The following table shows the calculations for the average company:

	Conven- tional Option	Option On Market Indexed Stock
Stock Price	100.00	100.00
Diversification Adjusted Price	65.81	53.56
Exercise Price	100.00	100.00
Volatility	0.441	0.408
Dividend Yield	0.56%	0.00%
Risk-free Rate	3.29%	3.29%
Option Term	6	6
Black-Scholes Value	44.32	44.32
B-S Value w/ Adjusted Price	21.40	13.75
Executive Value/Cost Ratio	0.483	0.310
Undiversified Discount Factor for Each Year of the Option Term	0.886	0.823

The executive value of the conventional option is 48.3% of its cost to the company. Thus, a conventional option with a cost to the company of \$0.650 has an executive value of \$0.314 ( $= .483 * \$0.650$ ). This is the value shown in the pay package table above. The executive value of the relative performance option, i.e., the option on the market indexed stock, is 31.0% of its cost to the company. Thus, a relative performance option with a cost to the company of \$0.487 has an executive value of \$0.151 ( $= .310 * \$0.487$ ). This is the value shown in the pay package table above.

The values of these two options to a diversified investor ("Black-Scholes Value" in the table above) are the same (\$44.32), but this is just a coincidence. The relative performance option is dividend protected which increases the option value and, coincidentally, exactly offsets the decline caused by the lower volatility. If the relative performance option had the same dividend yield as the conventional option, the option value to a diversified investor would only be \$41.83.

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### ***Calculation of Wealth Leverage***

The wealth leverage of an equity incentive is the ratio of the percentage change in the executive value of the equity incentive to the percentage change in shareholder wealth. The wealth leverage of restricted stock is 1.0 since any given percentage change in shareholder wealth results in an equal percentage change in the executive value of the restricted stock. The wealth leverage of an option is always greater than 1.0 since the percentage change in the option value exceeds the percentage change in the value of the stock. To calculate the wealth leverage of the conventional option and the relative performance option, we first calculate the executive value of the option when the exercise price is equal to the market price of the stock. We then increase the market price of the stock by 25% and calculate the executive value of the option again. The 25% stock price change increases the executive value of the conventional option by 49% and the value of the relative performance option by 56%. Thus, the wealth leverage of the conventional option is 1.96 (= 49%/25%) and the wealth leverage of the relative performance option is 2.23 (= 56%/25%). Since the wealth leverage of options is not constant, our wealth leverage results would change slightly if we calculated wealth leverage using a different percentage change in shareholder wealth.

The wealth leverage of a cash and equity incentive pay package is equal to the wealth leverage of the equity incentive multiplied by the percentage of executive value in the equity incentive (since cash has zero wealth leverage). The wealth leverage of the conventional option pay package is 0.925 (= (.314/.664) \* 1.96), or 82% more than the wealth leverage of the relative performance option, 0.509 (= (.151/.664) \* 2.23). The much lower wealth leverage of the relative performance pay package shows that relative performance options are far less efficient than a conventional option pay package.

### ***Why Relative Performance Stock and Options Have Such Low Executive Value***

Relative performance options are more efficient than conventional options for only 51 of the 1,394 companies in the S&P 1500 (106 companies are excluded from the analysis because they do not have five years of monthly return data reported on Compustat). 42 of the 51 companies where relative performance options are more efficient have a negative correlation with the market (i.e., the S&P 500) over the past 60 months (and these 42 companies are only companies in the sample with a negative correlation with the market). The remaining 9 companies where relative performance options are more efficient have a higher executive value for relative performance options than conventional options. This is due to a combination of dividend yield and volatility values. The difference between relative performance option and conventional option executive value is positively related to dividend yield and negatively related to volatility. The relative performance option executive value exceeds the conventional option executive value for 9 companies with high yield and low volatility.

The major reason why a relative performance option pay package is less efficient than a conventional option pay package is that market indexed stock, for companies with a positive correlation with the market, has more non-market risk than the stock itself. The risk of market indexed stock is all non-market risk and is equal to:

- risk of market indexed stock = stock volatility \* (1 - (correlation \* correlation))<sup>.5</sup>

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### ***Why Relative Performance Stock and Options Have Such Low Executive Value – cont'd***

The non-market risk of the stock is equal to:

- $\text{non-market risk of stock} = \text{stock volatility} * (1 - \text{correlation})$

If the correlation with the market is positive, the risk of the market indexed stock will always be greater than the non-market risk of the stock. The risk of the market indexed stock will be 29% greater at a correlation of .25, 73% greater at a correlation of .50 and 165% greater at a correlation of .75. Since non-market risk is the source of the difference between company cost and executive value, the additional non-market risk of market indexed stock results in a greater cost/value gap for relative performance options than for conventional options. The additional non-market risk of market indexed stock explains 60% of the differences between relative performance option pay package leverage and conventional option pay package leverage among the S&P 1500 companies with positive market correlations. An additional 30% of the differences in pay package leverage is explained by stock volatility (which increases relative performance option leverage relative to conventional option pay package leverage).

The market indexed stock return is the residual return from the stock beta regression, i.e., the regression of the stock return on the market return. The regression splits the stock return into two uncorrelated, or orthogonal, terms: the predicted value, which represents the market component of the return, and the error term, which represents the residual return.

Since the stock return is the sum of the two uncorrelated returns, the variance of the stock return is the sum of the variance of the market component of the return and the variance of the residual return:

- $\text{total variance} = \text{market variance} + \text{residual variance}$

Since variance is risk, or volatility, squared, we have:

- $\text{stock risk} * \text{stock risk} = \text{market risk} * \text{market risk} + \text{non-market risk} * \text{non-market risk}$

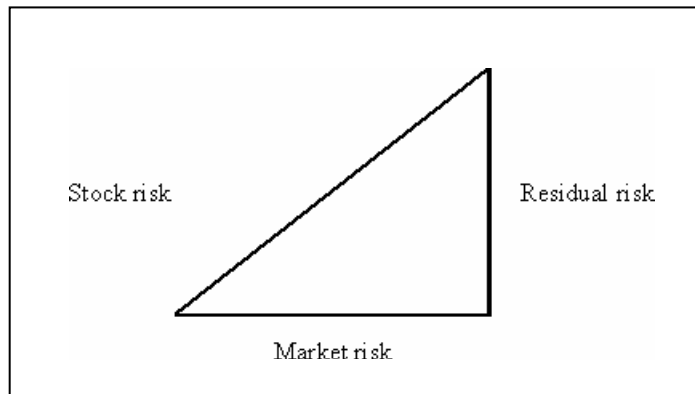
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### ***Why Relative Performance Stock and Options Have Such Low Executive Value – cont'd***

This shows that we can represent the stock risk and its two components as the sides of a right triangle:



From the right triangle, it is easy to see that:

- $\text{stock risk} < \text{market risk} + \text{residual risk}$
- $\text{stock risk} - \text{market risk} < \text{residual risk}$
- $\text{stock non-market risk} < \text{risk of market indexed stock}$

The construction of market indexed stock creates additional risk that didn't exist before. For the median company in the S&P 1500 (with a positive market correlation), the sum of the market risk and the non-market risk is 46% greater than the total risk of the stock.

### ***Why an Option on a Market Indexed Portfolio is a Better Measure of Relative Performance Than an Indexed Option***

An indexed option is a right to acquire the stock in exchange for a variable exercise price. The exercise price is adjusted to reflect the percentage change in the index. As Lisa Meulbroek shows in her working paper, a 10% increase in both the value of the stock and the market index increases the indexed option value by 10%. Since the indexed option can increase in value without the stock out-performing the index, it is not a perfect measure of relative performance. Meulbroek shows in her working paper that the market indexed portfolio eliminates this problem because equal percentage changes in the stock and the market index do not change the value of the market indexed portfolio and hence, do not change the value of an option on the market indexed portfolio.

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### ***References:***

Meulbroek, Lisa K., "The Efficiency of Equity-Linked Compensation: Understanding the Full Cost of Awarding Executive Stock Options," 2001 Financial Management 30, 5-44

Meulbroek, Lisa K., "Executive Compensation Using Relative-Performance-Based Options: Evaluating the Structure and Costs of Indexed Options, 2001 Harvard Business School Working Paper 01-021

O'Byrne, Stephen F., "Management's Valuation of Incentive Securities," 1992, Benefits Quarterly, 8, 51-56