



## **HOW DEFINED, BENEFIT PENSION ASSETS AFFECT THE RETURNS AND VOLATILITY OF THE SPONSOR'S STOCK**

\* Brooks Marshall, Timothy B. Michael,  
David M. Maloney and \*Faramarz Damanpour  
\* James Madison University, University of Virginia  
and University of Houston

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### **Abstract**

In its valuation of firms with defined benefit plans, the stock market combines changes in the valuation of pension assets with changes in the valuation of the net core assets. Unfortunately, aggregating the two disparate asset classes in valuation discards information about both classes. This work shows that by extracting the pension component of returns, two types of insights result: first, an enhanced understanding of the underlying risk and return of the firm's net core assets; and, second, an enhanced perspective of the potential benefit from incorporating pension asset allocation into overall risk management.

Keywords: Pension, Risk management, Valuation, Assets

JEL Classification: J32, M52

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### **1. Introduction**

When funding defined, benefit pension plans, firms are required by Federal law to place their sponsored assets into a trust. Any analysis of the sponsor's stock needs to recognize that stock returns reflect the performance operational and pension plan assets. Insights from such analysis can often be enhanced if the pension returns are extracted from the overall returns. As a result, such insights can improve both the firm's external and internal analysis. If, for instance, an investment analyst desires to evaluate the market's perception of a firm's competitive nature, removal of the pension returns could sharpen the analyst's understanding of the performance vis-a-vis its competitors. Likewise, focusing on the firm's operations could provide a more rational basis towards proper incentive compensation.

The analytical problems stemming from a valuation that combines different asset groups into one stock price are particularly problematic in the case of defined benefit pension plans. In general, pension assets are comprised of a well-diversified

portfolio of publicly traded securities. A close approximation of the portfolio held by a firm's pension fund could be readily gathered and held by other pension funds. The operational assets on the other hand, define the firm's business, competitors, and customers. Pertaining to its operational assets, the firm's management team distinguishes itself from its competitors through sound articulation and implementation of competitive strategies.. In addition, management's decisions can modify to a certain degree (at a specific level) the firm's industry affiliation. Moreover, in contrast to pension assets, operational assets tend to be rather illiquid and difficult to value since the strongest part of a firm can be comprised of attributes not reflected in the financial statements (i.e.,customer loyalty and innovative capabilities).

## **2. Literature Review**

Successfully "removing" the return on pension assets from market returns depends upon whether and how the market impounds pension returns in equity valuation. Since the latter part of the 1970s, the economic ownership of pension assets had not been resolved. Some had thought that the assets belonging to the employees were completely separate from the firm's equity valuation, while others considered the association of the firm's assets to its economic fortunes. A series of studies conducted by the likes of Oldfield, (1977), Feldstein and Seligman(1981), Daley (1984), Landsman (1986), Barth, Beaver, and Landsman (1992), Coronado and Sharpe (2003), and Franzoni and Marin (2006) had reasoned that the value of the pension assets is reflected in the value of the firm's common stock. The relationship is statistically significant and economically substantive with results suggesting that pension plan assets are valued on a one-to-one basis with the operating assets of the firm. The findings suggest that the returns on pension assets are impounded into equity returns.

The empirics of the valuation studies are generally consistent with the idea that US\$1 of pension assets corresponds to US\$1 of market value. However, the 1:1 relationship overstates theoretical expectations. Black (1980) had posited that the returns on pension assets would be impounded into the stock price on an after tax-basis because of the tax deductibility of the pension contribution. Because the sponsoring firm can deduct the contribution from taxable income, only the after-tax proportion (1- tax rate) of corporate cash is required to create \$1 in the pension plan. Consequently, US\$1 of returns produced by pension assets should impact the market value of the firm's stock by US\$1(1 - marginal tax rate). Bulow, Morck, and Summers (1987) had argued that US\$1 of pension returns may have US\$1 of equity value because the contributions to pension funds are constrained at the liability level. In this paper, we assume that pension returns are reduced by the tax rate when they are impounded into the stock's return. If the 1:1 relationship holds for a given firm, our analysis of the impact would qualitatively apply, but the proportions would change.

Both Coronado and Sharpe (2003), as well as Franzoni and Marin (2006), have challenged the effectiveness of the market's impounding. Neither study had

explicitly evaluated the returns of pension assets, but instead, had evaluated the net pension liability. Corronado and Sharpe had found that the market's valuation tended to rely more on the accounting aspect of the pension rather than that of the economic view. Franzoni and Marin's results did not support the broad claims of Corronado and Sharpe; they had found that the stock market did not incorporate pension-related, future cash flow information for severely underfunded plans. Zion (2002) had found that effective impounding is hindered by cumbersome and often time non-economic accounting representations. The outcry from the financial community regarding defined benefit reporting resulted in the promulgation of Financial Accounting Standard 158 in September 2006 (Financial Accounting Standards Board, 2006). Being that FAS 158 addresses many of the issues that may have impeded the economic interpretation of pension results, the likelihood of the capital markets correctly impounding the pension performance is enhanced, going forward.

Jin, Merton, Bodie (2006) (JMB) had provided an additional support for the equity market's impounding pension valuations, but had differed from the prior studies in two ways. Firstly, the authors had focused on the relationship between the systematic risk of the firm's stock returns (instead of the firm's market value) and the systematic risk of the pension plan. Secondly, JMB characterized their study as "dynamic," wherein their variables were based on changes instead of levels. JMB had found that the beta of the firm's stock was influenced by the beta of the pension assets. The impact was theoretically and statistically significant.

Like JMB, this paper specifically seeks to examine the dynamic returns of pension funds, but differs from JMB and other studies in that the focus strictly lies on the performance of pension assets without netting the impact of pension liabilities. The rationale is that pension liabilities stem from operational costs (i.e., the salaries of employees). Funding these liabilities before payments are due through the contribution to the pension fund is distinct from the firm's operations, albeit, legally required. In addition, the returns on the pension assets are much more subject to the sponsor's specific investment policy, whereas changes in the economic value of pension liabilities stem more from economy-wide changes in interest rates. In sum, we argue that pension returns are the component of pension plans that most confound the interpretation of how the equity market perceives the firm's operational performance. Moreover, the focus on pension returns allows for greater interpretation of the funding decision. We structured the model to enable a measurement of the firm's performance as if the pension was funded strictly on a pay-as-you-go basis.

### **3. Relative Size of Pension Assets and Market Capitalization**

#### **3.1 Data and Methodology**

Characteristics of pension plans are related to several industry-specific factors, including the age of the sponsoring firm and employees, as well as the financial status of the sponsoring firm (Ballester, Fried, and Livnat (1998); Friedman (1983); Blitzer, Silverblatt, and Guarino (2005)). By focusing on a single industry, we

are able to control some of these factors by paralleling the focus with an analyst's perspective (either internally or externally), in that the particular industry is often the initial point of reference.

The impact of pension returns developed below, where US\$1 of pension returns increases the stock price by US\$.65 (given the marginal corporate tax rate of 35 percent), depends on the assumption that the firms in the industry are financially healthy. For a firm with a questionable financial status, US\$1 of pension returns would have some chance of benefiting creditors and pension beneficiaries instead of shareholders. The automotive, steel, and airline industries are prime examples of industries where additional dollars of pension returns would benefit creditors or beneficiaries, and the returns would not accrue to the sole benefit of shareholders. We selected the oil industry because it has sizably defined benefit plans with unquestionable operational health. Our sample contains firms with the same four-digit SIC code (2911) from the Oil and Gas Industry. We also limited the group to those firms of the Standard & Poors 500 Index, which had data and published annual reports reported by Standard & Poors Compustat between 1991 and 2004. Five firms meet these criteria – Amerada Hess (HES), Chevron-Texaco (CVX), Exxon Mobil (XOM), ConocoPhillips (COP), and Sunoco (SUN).

Stock returns were obtained from CRSP, where as pension returns were obtained from the firms' 10-K reports. Here, beta is used to measure the systematic risk of the stock using a regression between the stock's annual returns and that of the Standard & Poors 500 Index over the 12-year period from 1992-2004. Being that pension returns are only reported annually, this analysis will use annual returns for the beta..

### **3.2 Sample Size of Pension Assets**

Panel A of Table 1 reports the size of the pension assets (PA) for each firm in the sample in absolute terms. COP's fund experienced the most rapid growth during the study period at a rate of 17 percent, while SUN had experienced negative growth at -1 percent. In 2004, the funds had represented a substantial portfolio in absolute terms with an average size of over \$6 billion.

Panel B of Table 1 presents the ratio of the size of the pension fund (PA) relative to the total market capitalization (MV). This ratio represents the potential for the pension fund to impact the sponsor's stock.

Comparing the data of 1991 and 2004 in Panel B indicates that all firms except HES experienced a decline in pension assets relative to market capitalization (PA/MV). This holds as Panel A demonstrates how the absolute level of pension assets has grown between 1991 and 2004. For example, XOM's PA/MV decreased from 10.0 percent in 1991 to 5.5 percent in 2004, even though the US dollar value of pension assets grew at an annual rate of 6.9 percent.

Simply put, market value grew faster than pension assets. Understanding "why" would provide an underpinning for the dynamics of the industry. Factors affecting the relative level of pension assets include labor intensity; contributions to the pension fund; returns achieved in the pension fund; and the substitution of defined contribution plans for defined benefit plans.

**Table 1: Pension Assets and Market Capitalization**

| <b>Panel A: Pension Assets (PA)</b>  |            |            |            |            |                                |            |  |
|--|------------|------------|------------|------------|--------------------------------|------------|--|
| <b>Year</b>  | <b>HES</b> | <b>CVX</b> | <b>XOM</b> | <b>COP</b> | <b>SUN</b>                     |            |  |
| 1991   | \$276      | \$4,507    | \$7,554    | \$412      | \$1,313                        |            |  |
| 1992   | 283        | 3,899      | 6,880      | 377        | 1,207                          |            |  |
| 1993   | 309        | 3,832      | 7,509      | 374        | 1,272                          |            |  |
| 1994   | 289        | 3,626      | 7,278      | 507        | 1,183                          |            |  |
| 1995   | 397        | 4,033      | 8,300      | 680        | 1,222                          |            |  |
| 1996   | 429        | 4,163      | 8,840      | 819        | 1,242                          |            |  |
| 1997   | 482        | 4,454      | 9,383      | 999        | 1,277                          |            |  |
| 1998   | 477        | 4,741      | 10,098     | 1,162      | 1,350                          |            |  |
| 1999   | 534        | 4,673      | 16,654     | 1,230      | 1,439                          |            |  |
| 2000   | 543        | 4,225      | 14,575     | 1,097      | 1,287                          |            |  |
| 2001   | 495        | 5,947      | 12,170     | 1,113      | 1,110                          |            |  |
| 2002   | 487        | 4,835      | 11,351     | 2,260      | 930                            |            |  |
| 2003   | 626        | 6,573      | 16,486     | 2,763      | 1,071                          |            |  |
| 2004   | 750        | 8,410      | 17,972     | 3,328      | 1,158                          |            |  |
| Annual<br>Growth<br>Rate   | 8.0%       | 4.9%       | 6.9%       | 17.4%      | -1.0%                          |            |  |
| <b>Pension Assets as a Proportion of Market Capitalization (PA/MV) (%)</b> |            |            |            |            |                                |            |  |
| <b>Year</b>  | <b>HES</b> | <b>CVX</b> | <b>XOM</b> | <b>COP</b> | <b>Average without<br/>SUN</b> | <b>SUN</b> | <b>Average<br/>for all<br/>5 firms</b> |
| 1991   | 7.2        | 18.8       | 10.0       | 6.6        | 10.7                           | 40.6       | 16.6                                   |
| 1992   | 6.6        | 17.3       | 9.1        | 5.8        | 9.7                            | 40.5       | 15.9                                   |
| 1993   | 7.4        | 13.5       | 9.6        | 4.9        | 8.9                            | 40.6       | 15.2                                   |
| 1994   | 6.8        | 12.5       | 9.6        | 5.9        | 8.7                            | 38.5       | 14.7                                   |
| 1995   | 8.1        | 11.8       | 8.3        | 7.6        | 9.0                            | 60.3       | 19.2                                   |
| 1996   | 8.0        | 9.8        | 7.3        | 7.0        | 8.0                            | 69.8       | 20.4                                   |
| 1997   | 9.6        | 8.8        | 6.2        | 7.8        | 8.1                            | 42.9       | 15.1                                   |
| 1998   | 10.6       | 8.8        | 5.7        | 10.8       | 9.0                            | 41.4       | 15.5                                   |
| 1999   | 10.4       | 8.2        | 5.9        | 10.3       | 8.7                            | 68.1       | 20.6                                   |
| 2000   | 8.4        | 7.8        | 4.8        | 7.6        | 7.2                            | 42.5       | 14.2                                   |
| 2001   | 8.9        | 6.2        | 4.5        | 4.8        | 6.1                            | 39.4       | 12.8                                   |
| 2002   | 9.9        | 6.8        | 4.8        | 6.9        | 7.1                            | 36.5       | 13.0                                   |
| 2003   | 13.1       | 7.1        | 6.1        | 6.2        | 8.1                            | 27.8       | 12.1                                   |
| 2004   | 9.9        | 7.6        | 5.5        | 5.5        | 7.1                            | 20.4       | 9.8                                    |
| Average over 14<br>years   | -          | -          | -          | -          | 9.0                            | 43.5       | 15.3                                   |

The most striking relation seen in Panel B is how Sun's PA/MV dominates the ratio for other firms. In any given year, SUN's PA/MV ratio is from 3 to 8 times that of other firms, with SUN's ratio being between 40 and 70 percent in most years, dropping to the 20 percent range in 2003 and 2004. In contrast, pension assets for the other plans tended to be less than 10 percent of market capitalization. We chose not to include SUN in our subsequent analysis of pension impact for two reasons. Firstly, SUN appears to be a different type of firm when compared with the other firms. It appears that SUN's financial assets play a much larger role in its performance. Secondly, SUN's pension fund appears to be a statistical outlier, disproportionately skewing any averages towards SUN's results.

As a result Tables 2 through 5 use HES, CVX, XOM, and COP to demonstrate how the impact of pension returns can be removed from stock market results and how the adjusted returns can be evaluated.

#### 4. The Impact of Pension Assets on the Stock's Return and Risk

Panel of Table 2 provides the returns on the firm's common stock, while Panel B highlights the returns on the pension assets.. Panel C (net core returns) shows the implied returns on the stock with the pension returns removed. Stock returns were obtained from CRSP, while pension returns were taken from the 10-K reports of the respective firms. However, disaggregating the pension returns from the overall stock returns required assumptions about what is impounded by the stock market. As discussed in the literature review, our model assumes each US\$1 of pension returns increases the market value of the firm by US\$0.65, given the 35 percent Federal income tax rate.

**Table 2:** Stock Returns, Pension Returns, and Net Core Returns (%)

|          | HES   | CVX    | XOM   | COP    | Overall |
|----------|-------|--------|-------|--------|---------|
| 1992     | 1.48  | 6.97   | 5.94  | 11.09  |         |
| 1993     | 1.13  | 28.23  | 7.94  | 20.77  |         |
| 1994     | 4.62  | 8.02   | 1.99  | 18.63  |         |
| 1995     | 17.72 | 21.21  | 34.08 | 9.26   |         |
| 1996     | 11.60 | 25.95  | 23.42 | 31.34  |         |
| 1997     | -2.01 | 21.22  | 26.20 | 13.78  |         |
| 1998     | -5.87 | 12.56  | 21.81 | -7.83  |         |
| 1999     | 16.30 | 10.15  | 14.21 | 16.03  |         |
| 2000     | 33.04 | 5.36   | 11.26 | 30.12  |         |
| 2001     | -9.97 | 10.18  | -6.90 | 10.83  |         |
| 2002     | -2.78 | -23.85 | -7.18 | -17.00 |         |
| 2003     | 2.13  | 32.41  | 19.93 | 35.76  |         |
| 2004     | 49.49 | 23.59  | 25.16 | 31.98  |         |
| Average  | 8.99  | 14.00  | 13.68 | 15.75  | 13.11   |
| Vol (SD) | 16.78 | 14.45  | 12.91 | 15.46  | 14.90   |
| Beta     | 0.028 | 0.162  | 0.598 | 0.419  | .393    |



*(continued)*

| <b>Panel B: Pension Returns</b> |            |            |            |            |                |
|---------------------------------|------------|------------|------------|------------|----------------|
|                                 | <b>HES</b> | <b>CVX</b> | <b>XOM</b> | <b>COP</b> | <b>Average</b> |
| 1992                            | 7.01       | 6.86       | 5.40       | 1.70       |                |
| 1993                            | 12.41      | 12.11      | 17.51      | 6.63       |                |
| 1994                            | -3.02      | 1.62       | -0.43      | 0.00       |                |
| 1995                            | 23.18      | 20.08      | 19.52      | 24.06      |                |
| 1996                            | 10.31      | 12.47      | 14.28      | 10.00      |                |
| 1997                            | 14.82      | 16.74      | 16.01      | 20.63      |                |
| 1998                            | 11.27      | 15.15      | 14.21      | 13.71      |                |
| 1999                            | 13.27      | 15.19      | 35.16      | 12.91      |                |
| 2000                            | -2.44      | 2.35       | 1.18       | -0.57      |                |
| 2001                            | -7.18      | -7.36      | -7.35      | -10.03     |                |
| 2002                            | -8.48      | -7.11      | -11.48     | -14.29     |                |
| 2003                            | 21.36      | 18.80      | 21.50      | 15.97      |                |
| 2004                            | 11.82      | 12.44      | 12.45      | 11.83      |                |
| Average                         | 8.03       | 9.18       | 10.61      | 7.12       | 8.74           |
| Vol (SD)                        | 10.28      | 9.21       | 12.77      | 11.36      | 10.90          |
| Beta                            | 0.511      | 0.873      | 1.244      | 0.748      | .844           |

  

| <b>Panel C: Net Core Returns (%)</b> |            |            |            |            |                |
|--------------------------------------|------------|------------|------------|------------|----------------|
|                                      | <b>HES</b> | <b>CVX</b> | <b>XOM</b> | <b>COP</b> | <b>Overall</b> |
| 1992                                 | 1.23       | 6.98       | 5.97       | 11.45      |                |
| 1993                                 | 0.56       | 29.78      | 7.30       | 21.24      |                |
| 1994                                 | 4.97       | 8.59       | 2.15       | 19.37      |                |
| 1995                                 | 17.42      | 21.30      | 34.91      | 8.49       |                |
| 1996                                 | 11.67      | 26.87      | 23.88      | 32.36      |                |
| 1997                                 | -3.13      | 21.49      | 26.63      | 13.41      |                |
| 1998                                 | -7.14      | 12.40      | 22.10      | -9.46      |                |
| 1999                                 | 16.51      | 9.87       | 13.37      | 16.25      |                |
| 2000                                 | 35.08      | 5.52       | 11.59      | 31.71      |                |
| 2001                                 | -10.14     | 10.92      | -6.89      | 11.50      |                |
| 2002                                 | -2.37      | -25.67     | -7.03      | -17.29     |                |
| 2003                                 | 0.29       | 33.90      | 19.86      | 37.57      |                |
| 2004                                 | 52.11      | 24.19      | 25.65      | 33.58      |                |
| Average                              | 9.00       | 14.32      | 13.81      | 16.17      | 13.32          |
| Vol (SD)                             | 17.80      | 15.21      | 13.11      | 16.30      | 15.60          |
| Beta                                 | -0.005     | 0.131      | 0.553      | 0.395      | .36            |

Beta is one of the most widely used measures of risk. Here it measures the systematic risk of the stock using a regression between the stock's annual returns and the annual returns for the Standard & Poors 500 index return over the 1992-2004 time period. Beta is typically computed using monthly returns; however, this analysis uses annual returns because pension returns are only reported annually.

In order to isolate the influence of pension assets in equity returns, our model of the firm is as follows:

$$MV_f = MV_{ca} + MV_{pa}$$

Where:

$MV_f$ : the equity value/price per share of the firm multiplied by the total number of shares outstanding

$MV_{ca}$ : the firm's assets and liabilities (including the pension liability), excluding pension assets

$MV_{pa}$ : year-end market value as reported in the annual reports of the sponsoring firms. The model is analogous to a two-asset portfolio where the overall portfolio value (market value of firm) and one portfolio component (pension assets) are observable, but the other asset (core assets) is not directly observable.

Returns and rates of return can also be depicted in the context of the two-asset portfolio:

$$E_{ROR} = (\text{Weight}_{ca} * \text{Net Core ROR}) + (\text{Weight}_{pa} * \text{Pension Asset ROR})$$

Where:

$E_{ROR}$ : annual rate of return realized by shareholders.

$\text{Net Core ROR}$ : the firm's assets and liabilities (including the pension liability) minus pension assets.

$\text{Weight}_{ca}$ : proportion of market value in Core Assets or  $1 - (\text{PA}(1-\text{Tx}) / \text{MVEQ})$ .

$\text{Weight}_{pa}$ : proportion of market value in pension assets or  $\frac{\text{PA}(1-\text{Tx})}{\text{MVEQ}}$ , with Tx equal to the maximum marginal corporate tax rate of 35 percent.

$\text{Pension Asset ROR}$ : annual rate of return for pension assets, presented in accordance with FAS 158, with reported pension returns divided by beginning of the year pension assets.

The  $\text{Net Core ROR}$  can then be specified in terms of observable asset returns, as in equation 1:

$$\text{Net Core ROR} = \frac{\text{Equity ROR} - (\text{Weight}_{pa} * (1-\text{Tx}) * \text{Pension Asset ROR})}{\text{Weight}_{ca}} \quad (1)$$



For example, the return on COP's net core assets in 2004 is computed as:

$$\text{Net Core ROR} = [31.98\% - (5.5\% * .65 * 11.83\%)]/[1-(5.5\% * 0.65\%)] = 33.58\%$$

The first two panels in Table 2 allow direct comparison of the stock returns in Panel A and pension returns in Panel B. For the period 1992-2004, stocks outperformed the pension funds for all four firms. Note however, that the two different risk measures give different signals. The stocks (relative to pension funds) had lower betas with higher standard deviations. Panel C of Table 2 presents these metrics for net core returns (arithmetic mean, standard deviation, and beta).

Comparing the net core returns (Table 2, Panel C) with stock returns (Table 2, Panel A) measures the impact of pension asset performance. The comparison is summarized in Table 3. The surprising result is the consistency across firms. Each of the firms' returns and standard deviations were reduced by the pension fund's performance. These results are somewhat understandable since oil and gas companies have had a strong performance over the time horizon examined. The reduction in volatility follows since pension funds are generally well diversified, as demonstrated in the low standard deviation of pension stock returns. The most surprising metric was beta. Being that pension assets typically include bonds, one would expect the pension fund to reduce beta; however, removing the pension returns reduced the beta for each of the firms. The averages shown in Table 3 indicate that pension funds reduced stock returns by an average of 22 basis points, with a reduction of the standard deviation from 15.6% to 14.9% and increased beta from 0.36 to 0.39.

**Table 3:** Impact of the Pension Fund Performance on Stock Returns (%)

|          | HES   | CVX   | XOM   | COP   | Average |
|----------|-------|-------|-------|-------|---------|
| Return   | -0.02 | -0.32 | -0.13 | -0.42 | -0.22   |
| Vol (SD) | -1.02 | -0.76 | -0.21 | -0.84 | -0.71   |
| Beta     | 3.31  | 3.11  | 4.52  | 2.45  | 3.35    |

### 5. Correlations and the Risk of Pension Assets

The conflict between risk measures stems from the inter-company correlations of pension returns and net core returns. Even though volatility assesses the returns of an asset as an independent set of numbers, many analysts find that a metric measuring how the security relates to a broader portfolio is more relevant.

Another view, especially relevant from a portfolio manager's perspective, concerns the volatility of a representation of the industry as a whole. We construct an "Integrated Oil and Gas" portfolio with equal weights in each security, and then compute the portfolio return. We then analyze the portfolio, pension, and net core return. The return for this portfolio is the arithmetic average of the four returns

for each year. Table 4 provides the returns for an equally weighted portfolio for each year. The “Diversification Reduction” column compares the average standard deviation for the four oil companies  $((SD_{HES} + SD_{CVX} + SD_{XOM} + SD_{COP})/4)$  with the standard deviation of the portfolio. The percentage difference stems from the portfolio returns being less than perfectly correlated. Because the pension funds are typically well diversified, the relative comparison of the results with the diversification impact of combining pension returns being much smaller, is logical. But the degree of difference is surprising. Pension fund diversification only reduces the standard deviation of 10.90% for the average of the four pension standard deviations to 10.11% for the portfolio of four pension funds, and a reduction in volatility of 7.25% ( $(10.90\% - 10.11\%)/10.90\% = 7.25\%$ ). On the other hand, the portfolio reduction for the net core returns is over 26%, with the average net core’s standard deviation being 15.60% and the portfolio of net core return’s having a standard deviation of only 11.52 percent, where  $(15.60\% - 11.52\%)/15.60\% = 26.16$  percent.

The reduction in standard deviation presented above stems from the degree of diversification, serving as a reminder to the basic principles of modern portfolio theory. As Table 5 demonstrates, the correlations among pension returns are much higher than the correlation among net core assets, explaining the diversification difference between the two portfolio combinations. Table 5 presents the correlations across all components.

**Table 4:** Portfolio Risk

| <b>Panel A: Stock Returns (%)</b> |               |        |                 |        |                   |                           |
|-----------------------------------|---------------|--------|-----------------|--------|-------------------|---------------------------|
| Year                              | Stock Returns |        |                 |        | Portfolio Average | Diversification Reduction |
|                                   | HES           | CVX    | XOM             | COP    |                   |                           |
| 1992                              | 1.48          | 6.97   | 5.94            | 11.09  | 6.37              |                           |
| 1993                              | 1.13          | 28.23  | 7.94            | 20.77  | 14.52             |                           |
| 1994                              | 4.62          | 8.02   | 1.99            | 18.63  | 8.31              |                           |
| 1995                              | 17.72         | 21.21  | 34.08           | 9.26   | 20.57             |                           |
| 1996                              | 11.60         | 25.95  | 23.42           | 31.34  | 23.08             |                           |
| 1997                              | -2.01         | 21.22  | 26.20           | 13.78  | 14.80             |                           |
| 1998                              | -5.87         | 12.56  | 21.81           | -7.83  | 5.17              |                           |
| 1999                              | 16.30         | 10.15  | 14.21           | 16.03  | 14.17             |                           |
| 2000                              | 33.04         | 5.36   | 11.26           | 30.12  | 19.94             |                           |
| 2001                              | -9.97         | 10.18  | -6.90           | 10.83  | 1.04              |                           |
| 2002                              | -2.78         | -23.85 | -7.18           | -17.00 | -12.70            |                           |
| 2003                              | 2.13          | 32.41  | 19.93           | 35.76  | 22.56             |                           |
| 2004                              | 49.49         | 23.59  | 25.16           | 31.98  | 32.55             |                           |
| Average                           | 8.99          | 14.00  | 13.68           | 15.75  | 13.11             |                           |
| Vol (SD)                          | 16.78         | 14.45  | 12.91           | 15.46  | 14.90             |                           |
|                                   |               |        | SD of Portfolio |        | 11.16             | 25.10                     |

(continued)

| <b>Panel B: Pension Returns (%)</b> |                 |       |                 |        |                   |                           |
|-------------------------------------|-----------------|-------|-----------------|--------|-------------------|---------------------------|
| Year                                | Pension Returns |       |                 |        | Portfolio Average | Diversification Reduction |
|                                     | HES             | CVX   | XOM             | COP    |                   |                           |
| 1992                                | 7.01            | 6.86  | 5.40            | 1.70   | 5.24              |                           |
| 1993                                | 12.41           | 12.11 | 17.51           | 6.63   | 12.16             |                           |
| 1994                                | -3.02           | 1.62  | -0.43           | 0.00   | -0.46             |                           |
| 1995                                | 23.18           | 20.08 | 19.52           | 24.06  | 21.71             |                           |
| 1996                                | 10.31           | 12.47 | 14.28           | 10.00  | 11.77             |                           |
| 1997                                | 14.82           | 16.74 | 16.01           | 20.63  | 17.05             |                           |
| 1998                                | 11.27           | 15.15 | 14.21           | 13.71  | 13.59             |                           |
| 1999                                | 13.27           | 15.19 | 35.16           | 12.91  | 19.13             |                           |
| 2000                                | -2.44           | 2.35  | 1.18            | -0.57  | 0.13              |                           |
| 2001                                | -7.18           | -7.36 | -7.35           | -10.03 | -7.98             |                           |
| 2002                                | -8.48           | -7.11 | -11.48          | -14.29 | -10.34            |                           |
| 2003                                | 21.36           | 18.80 | 21.50           | 15.97  | 19.41             |                           |
| 2004                                | 11.82           | 12.44 | 12.45           | 11.83  | 12.14             |                           |
| Average                             | 8.03            | 9.18  | 10.61           | 7.12   | 8.74              |                           |
| Vol (SD)                            | 10.28           | 9.21  | 12.77           | 11.36  | 10.90             |                           |
|                                     |                 |       | SD of Portfolio |        | 10.11             | 7.24                      |

  

| <b>Panel C: Net Core Returns (%)</b> |                  |        |              |        |                   |                           |
|--------------------------------------|------------------|--------|--------------|--------|-------------------|---------------------------|
| Year                                 | Net Core Returns |        |              |        | Portfolio Average | Diversification Reduction |
|                                      | HES              | CVX    | XOM          | COP    |                   |                           |
| 1992                                 | 1.23             | 6.98   | 5.97         | 11.45  | 6.41              |                           |
| 1993                                 | 0.56             | 29.78  | 7.30         | 21.24  | 14.72             |                           |
| 1994                                 | 4.97             | 8.59   | 2.15         | 19.37  | 8.77              |                           |
| 1995                                 | 17.42            | 21.30  | 34.91        | 8.49   | 20.53             |                           |
| 1996                                 | 11.67            | 26.87  | 23.88        | 32.36  | 23.69             |                           |
| 1997                                 | -3.13            | 21.49  | 26.63        | 13.41  | 14.60             |                           |
| 1998                                 | -7.14            | 12.40  | 22.10        | -9.46  | 4.47              |                           |
| 1999                                 | 16.51            | 9.87   | 13.37        | 16.25  | 14.00             |                           |
| 2000                                 | 35.08            | 5.52   | 11.59        | 31.71  | 20.97             |                           |
| 2001                                 | -10.14           | 10.92  | -6.89        | 11.50  | 1.35              |                           |
| 2002                                 | -2.37            | -25.67 | -7.03        | -17.29 | -13.09            |                           |
| 2003                                 | 0.29             | 33.90  | 19.86        | 37.57  | 22.90             |                           |
| 2004                                 | 52.11            | 24.19  | 25.65        | 33.58  | 33.88             |                           |
| Average                              | 9.00             | 14.32  | 13.81        | 16.17  | 13.32             |                           |
| Vol (SD)                             | 17.80            | 15.21  | 13.11        | 16.30  | 15.60             |                           |
|                                      |                  |        | SD Portfolio |        | 11.52             | 26.19                     |

**Table 5:** Correlations Between Components of Firm Returns (%)

|           | Stock Returns | Pension Returns | Net Core Returns |
|-----------|---------------|-----------------|------------------|
| HES & CVX | 15.81         | 97.39           | 15.32            |
| HES & XOM | 36.86         | 86.84           | 39.54            |
| HES & COP | 60.68         | 94.25           | 53.04            |
| CVX & XOM | 66.89         | 89.76           | 64.09            |
| CVX & COP | 67.19         | 97.26           | 69.97            |
| XOM & COP | 33.87         | 84.06           | 31.76            |
| Average   | 46.88         | 91.59           | 45.62            |

  

| <b>Within-Firm Correlations</b> |                      |                   |
|---------------------------------|----------------------|-------------------|
|                                 | Net Core vs. Pension | Stock vs. Pension |
| HES                             | 13.99                | 17.80             |
| CVX                             | 73.00                | 74.59             |
| XOM                             | 68.61                | 70.78             |
| COP                             | 29.69                | 32.54             |
| Average                         | 46.32                | 48.93             |

The net core returns have an average correlation among all possible combinations of the four firms of only 45.6 percent, whereas the correlation among pension assets is 91.6 percent. Even though pension assets have no direct industry affiliation, their performance appears to increase the similarity in the equity market behavior across firms. In other words, the pension assets increase the correlations among the firms from 45.62 percent to 46.88 percent. Pension assets exaggerate the apparent industry affiliation, even though pension assets, in fact, diminish any industry-specific interrelationship.

The bottom panel in Table 5 includes the correlations between the pension returns and the net core returns, as well as the correlations between the pension returns and the stock returns. Note that the correlations are always greater for the pension to stock relationship because the stock return includes the pension return. Authors like Haugen(1989) and Jin, Merton, & Bodie (2006) suggest that firms may integrate pension asset allocation into overall firm risk management. The advantage to minimizing the correlation between net core returns and pension returns is that the firm is less likely to experience poor performance from operations when the pension assets are performing poorly. HES, by far, has the lowest correlation. If the relationship from the past holds into the future, HES would have less of a chance in facing binding constraints from being forced to make up for poor pension performance.

## 6. Conclusion

While the demonstration was applied to healthy firms with the assumption that shareholders were the sole beneficiaries of pension performance, the model could be widely applied. Neither creditors (for firms at risk of default) nor employees (who would increase claims on retirement income if the pension performed well, Jin, Merton, & Bodie (1996)) were assumed to play a role in this analysis. For firms with some prospect of other claimants on pension assets, the model would be modified to estimate the likelihood of diminished impact of pension returns on stock returns.

As discussed, pension assets may confuse the understanding of industry-specific impacts, by increasing the inter-firm correlation, but not for industry-specific events. Such insight is likely to prove useful for external analysts in their attempts to understand the firm's competitive position going forward. More specifically, a clear understanding of the role of pension returns would help industry-based long-short decisions for hedge funds to interpret the net result of changes in oil prices. For internal analysts, extracting pension returns could help in the assessment of the market's interpretation of the effectiveness of competitive strategy.

Knowledge of the net core assets' risk factors should enable management to select pension assets that have low sensitivity to firm/industry-specific or firm-specific risk factors (Haugen (1989); Jin, Merton, and Bodie (2006)). Managing pension assets to minimize correlation with the net core assets would diminish the probability that the firm would experience a "double-down" or poor performance from both asset groups simultaneously. Evidence of such management should appear in low correlation between pension returns and net core returns (Table 5).

In addition, pension plans can be readily compared within the industry. For example, XOM's pension has clearly outperformed its competitors in the industry, but only by assuming greater risk, both in terms of beta and standard deviation (Table 2). Comparing pension performance in the context of competitors may allow a rethinking of how the firm wishes to address asset allocation and funding levels.

For human resource compensation decisions, compensation plans based on stock performance are clearly impacted by the presence, size, and performance of pension funds. Extracting the pension results from the stock returns would have improved the compensation basis for COB by 42 basis points and CVX by 32 basis points (Table 3). Net core results may or may not have generated greater returns. However, it seems likely that employee options would tend to have more value if based on the more volatile net core returns instead of the sponsor's stock return.

**Author statement:** Brooks Marshall (E-mail: [marshasb@jmu.edu](mailto:marshasb@jmu.edu)) is the submitting author. He is a professor of finance at the James Madison University.

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