

Improving the Coverage of the DuPont Approach of Financial Analysis in Finance Courses Through the Use of the Net Leverage Multiplier

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Abstract

This paper points out a deficiency in the coverage of the DuPont system of financial analysis in most finance textbooks and provides an alternative that more accurately aligns the analytical measures to the factors affecting a firm's return on equity. Furthermore, we analyze data on firms to determine the extent to which the recommended alternative differs from the "standard" measures.

Introduction

One of the common methods of financial analysis is to make use of financial ratios in order to compare current with past performance and with an industry standard or some other target of performance. Most finance textbooks have a chapter such as Financial Statement Analysis, Ratio Analysis or some similarly titled chapter. In such chapters, it is pointed out that there are substantial interrelationships among financial ratios. One of the more familiar methods of depicting the interrelated nature of financial ratios is through the DuPont system of financial analysis. A review of 20 texts in Business Finance and/or Investments identified 18 that included coverage of the DuPont approach.

Briefly, the DuPont system decomposes the return on equity (*ROE*) into a set of factors that affect *ROE*. Each of these three factors can then be further decomposed in order to evaluate what may appear to be adequate or inadequate performance in the specific area. The most common approach in the textbooks is to cover what is generally referred to as the extended DuPont Equation, a 3-factor model. The three factors are: (1) asset utilization; (2) relative profitability; and (3) financial leverage. Specifically, the extended DuPont Equation is:

$$\frac{NI}{E} = \frac{S}{A} \cdot \frac{NI}{S} \cdot \frac{A}{E},$$

where: *NI* = net income; *E* = equity; and, *S* = sales. Of the 18 texts covering the DuPont approach, 15 discuss the above 3-factor model.

While the 3-factor model is useful, it does have one significant flaw. The three factors are not independent. For example, additional financial leverage increases *Assets/Equity*, often referred to as the *Equity Multiplier (EM)*. However, due to increased interest expense, increased financial leverage reduces the net profit margin (*Net Income/Sales*). Thus, *Assets/Equity* does not adequately measure the impact on *ROE* of financing with debt. *Assets/Equity* measures only the positive effect on *ROE* of increasing the proportion of debt in financing the firm's assets. Use of the equity multiplier alone to measure the use of financial leverage overstates the its effect on *ROE*. A better measure would be one that takes into account

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both the positive and negative effects of increased financial leverage. A better model for analysis is the four-factor model as shown below in its simplest form.

$$ROE = \frac{S}{A} \bullet \frac{[1-T][EBIT]}{S} \bullet \frac{NI}{[1-T][EBIT]} \bullet \frac{A}{E},$$

where *EBIT* is earnings before interest and taxes and the other terms are as defined previously. The refined equation can now be used to analyze the performance in terms of the three measures: (1) efficient asset use as measured by *Sales/Assets*; (2) relative profitability of sales as measured by $[1-T][EBIT]/Sales$; and (3) use of financial leverage as measured by the product of (*Net Income/[1-T][EBIT]*) and (*Assets/Equity*).

In our review of the twenty textbooks in Business Finance and Investments, we found only three whose coverage extended beyond the three factor-model. In each of these textbooks, the authors presented a five-factor model that included a factor for the tax burden. The three were: (1) Bodie, Kane & Marcus (1999); (2) Jones (2000); and (3) Reilly (1994), all Investments texts. While there may be some Business Finance texts that present the four-factor model, they certainly would be in the minority.

The Net Leverage Multiplier (NLM)

The first term in the four-factor model is the same as the corresponding term in the original equation. *Sales/Assets* is an adequate measure of asset utilization. In measuring the relative profitability of sales, $[1-T][EBIT]/Sales$ replaces *Net Income/Sales*. Firms with the same operating resources would be expected to generate similar $[1-T][EBIT]$ even if the capital structures were quite different. However, Net Income would be affected by capital structure differences. The new measure is thus a better proxy for relative operating performance.

In interpreting the net effect of financial leverage on *ROE*, the product of *Net Income/[1-T][EBIT]* and *Assets/Equity* replaces *Assets/Equity* as the measure of the effect of financial leverage on *ROE*. We refer to this new term as the *Net Leverage Multiplier (NLM)*.

$$NLM = \frac{NET\ INCOME}{[1-T][EBIT]} \bullet \frac{ASSETS}{EQUITY}.$$

By replacing equity in the firm's capital structure with debt, the equity base is reduced and *ROE* is increased if other things remain as in the past. However, income is reduced due to the additional interest expense and thus *ROE* is reduced as well. Whether the net effect on *ROE* is positive or negative is a function of the relative change in the two components. The net relative effect of using financial leverage is defined by the *NLM*, the product of the two terms. Hopefully, the relative reduction in equity is greater than the relative reduction in income, thereby increasing the *ROE*. As is generally known, this happens when *EBIT/Assets* (basic earning power) exceeds the interest rate on the debt.

The size of the net effect on *ROE* of financial leverage can be readily determined by analysis of the two ratios relative to those of a firm using no financial leverage. For the firm with no debt, the ratio term *Net Income/[1-T][EBIT]* will be 1.0. Furthermore, for the same firm, *Assets/Equity* will also be 1.0. Thus, the product of the two terms will also be 1.0 for the firm with no debt. A *NLM* value of anything greater than 1.0 indicates that leverage has increased *ROE*. Whether or not it has been increased sufficiently to justify the increased risk associated with incurring additional fixed financial expense is dependent upon the investors' risk return trade-off preferences and is not addressed in this paper.

While the computed value of the *NLM* would be undefined when *EBIT* is zero and would be negative when *EBIT* is negative, it is obvious that the use of financial leverage is not beneficial in such cases. However, if the equity is also negative, the value of the *NLM* would be positive and could be quite large if

the equity is negative but close to zero. In such a case the calculated value for the *NLM* would suggest a positive effect when it would be obvious that the firm was not earning its interest and the use of additional debt would not increase the *ROE*. Thus, for firms with negative equity, the *NLM* would not be accurate. However, it would be obvious that financial leverage had not been employed successfully. In the typical case (a firm with positive equity) the product of the two terms will be greater than 1.0 if leverage is successfully used and less than 1.0 if the use of leverage is unsuccessful.

While the overall effect of using various levels of debt in one's capital structure should be readily apparent to most, the *NLM* verifies not only the success or lack of success but also measures the degree to which leverage has been successfully or unsuccessfully employed. Thus, the *NLM* provides useful information to those interested in the evaluation of a firm's use of debt in its capital structure.

An example can provide some insight. Consider Deere which had a *ROE* in 2000 of 9.3%. Using the DuPont factors, we decompose the *ROE* into an *asset turnover* of .634, a *profit margin* of .031 and an *EM* of 4.76. Our suggested decomposition breaks the *ROE* into the same .634 for asset turnover, but .065 for the measure of operating profitability, and a *Net Leverage Multiplier* of only 2.27 (.477*4.76). While the benefit from the use of leverage is significant for Deere in 2002, leverage did not magnify the return by 4.76, but only by 2.27 times, an effect only 47.7% of that suggested by the *Equity Multiplier (EM)*.

Analyzing the Net Leverage Multiplier Over the Years 1996-2000

We gathered information from the S&P 1500 Super Composite Index Database for the years 1996-2000. Eliminating firms with missing information reduced the S&P Super Set to 1166 usable firms. We also eliminated firms with negative stockholders equity at any point in the five-year period, resulting in a useable set of 1138 firms. Table 1 shows the distribution of *NLM* values by years. In our calculation of the *NLM*, we deducted all non-financial expenses (as reported in the S&P 1500 Super Composite Index Database) from the reported *EBIT* to determine our estimate of *EBIT*.

Table 1
Net Leverage Multiplier
Distribution of Firms: 1996-2000

| | <u>1996</u> | <u>1997</u> | <u>1998</u> | <u>1999</u> | <u>2000</u> |
|-----------|-------------|-------------|-------------|-------------|-------------|
| <0 * | 20 | 21 | 21 | 27 | 30 |
| 0-0.999 | 38 | 36 | 30 | 47 | 42 |
| 1-1.999 | 662 | 669 | 647 | 625 | 625 |
| 2-2.999 | 270 | 273 | 275 | 285 | 295 |
| 3-3.999 | 77 | 69 | 69 | 63 | 64 |
| 4-4.999 | 24 | 28 | 36 | 30 | 27 |
| 5-5.999 | 11 | 10 | 20 | 22 | 22 |
| 6 or more | 36 | 32 | 40 | 39 | 33 |
| Total | 1138 | 1138 | 1138 | 1138 | 1138 |

*These are firms for which other non-financial expenses > reported EBIT.

Analysis of Table 1 reveals what we might expect. First, the number of firms for whom the use of leverage is undesirable (firms with a *NLM* value less than 1.0) is relatively small and reasonably consistent over the five years. Of the 1138 firms in the sample, the range of firms not successfully using leverage is from 51 (4.48%) in 1998 to 74 (6.50%) in 1999. Secondly, the distribution of the *NLM* values greater than 1.0 is also rather consistent over the 5-years period.

Table 2 shows the *Net Leverage Multiplier (NLM)* as a proportion of the *Equity Multiplier (EM)*. It should be noted that the firms with negative *NLM* will have differences larger than the *EM* and thus will have proportional differences greater than 1.0. Thus, the firms in the < 1.000 row are the identical firms in the first row of Table 1.

Table 2
 Net Leverage Multiplier/Equity Multiplier
 Distribution of Firms: 1996-2000

| | 1996 | 1997 | 1998 | 1999 | 2000 |
|---------|------|------|------|------|------|
| >=1.000 | 96 | 81 | 109 | 92 | 89 |
| .9-.999 | 401 | 422 | 377 | 333 | 301 |
| .8-.899 | 236 | 230 | 231 | 238 | 260 |
| .7-.799 | 155 | 154 | 154 | 159 | 147 |
| .6-.699 | 103 | 102 | 109 | 123 | 124 |
| .5-.599 | 51 | 50 | 52 | 62 | 73 |
| .4-.499 | 22 | 34 | 31 | 37 | 45 |
| .3-.399 | 27 | 18 | 18 | 25 | 36 |
| .2-.299 | 11 | 14 | 20 | 24 | 15 |
| .1-.199 | 12 | 8 | 11 | 13 | 11 |
| 0-.099 | 4 | 4 | 5 | 5 | 7 |
| <0.000 | 20 | 21 | 21 | 27 | 30 |
| Total | 1138 | 1138 | 1138 | 1138 | 1138 |

For most firms, the relative size of the overstatement of the financial leverage effect on *ROE* is less than 30% of the *EM*. However, in some cases the percentage error is much larger. More importantly, we can also note a trend in Table 2. Over this five-year period, the negative effect on *ROE* became more pronounced than the positive effect on *ROE*. We can see that 91 firms shifted from the less than 70% or more categories (888 firms in 1996 and 797 firms in 2000) to the less than 70% categories (250 firms in 1996 and 341 firms in 2000). The data suggest that a notable proportion of these came from the .9-.999 classification, which dropped by roughly 25 percent over the observed period. The 91 firms represent 8 percent of the total sample and increase the proportion in the less than 70% classification from 22% to 30% of the sample. Furthermore, the number of firms with the greater effects also grew consistently from 1996 to 2000. For example, in 1996, 96 firms (8.44%) had a *NLM* that was less than 50% of its *Equity Multiplier*. The number of such firms grew each year over the next four years and reached a level of 144 firms (12.65%) in 2000 with a *NLM* 50% or less than its *Equity Multiplier*.

Conclusion

This paper has presented a case for replacing the three factor DuPont system of financial analysis in finance textbooks with the four factor model which more accurately aligns measurements with the three factors affecting the firm's Return on Equity: (1) efficiency of asset use; (2) relative operating profitability; and (3) use of financial leverage. Furthermore, it has been shown that the errors involved with the use of the *Equity Multiplier (Assets/Equity)* as a measurement of the effect of the use of financial leverage have been substantial for many firms and that the average size of the error has grown over the years 1996-2000. We believe that the *Net Leverage Multiplier* merits inclusion in Finance texts, especially those used in courses for finance majors and graduate courses. Courses containing significant coverage of financing decisions and leverage effects should provide students with enhanced understanding of the multi-dimensional effects of leverage instead of the simplistic effect presented in many but not all current textbooks.

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