

Breaking Down ROE Using the DuPont Formula

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Article Highlights

- ROE calculates the return a company earns from shareholder's equity.
- The DuPont formula reveals the source of those returns: sales, marketing or debt.
- Comparing a company's financial performance to its peers can provide a useful context for analyzing ROE.

Return on equity (ROE) is a commonly used profitability ratio that measures the effectiveness of management in generating earnings for shareholders.

Return on equity measures net income less preferred dividends against total stockholder's equity. The three primary drivers of ROE are better sales (or turnover), greater margins and higher debt levels, each of which can lead to a higher ROE. Although return on equity is a useful tool, it does not tell you what factors are helping or hurting the company's performance. The DuPont formula addresses this concern by breaking down ROE and allowing investors to see which characteristics are driving ROE. Analysis of the DuPont formula allows you to determine whether management is generating value for shareholders effectively.

Return on Equity

Return on equity measures the level of income attributed to shareholders against the investment that shareholders put into the firm. In other words, it measures how efficiently a company is able to generate profits using shareholder's equity, which includes stock offerings and retained earnings.

There are different ways to calculate ROE. The denominator of the equation, total shareholder's equity, can simply be the shareholder's equity at the end of the period, which is found on the balance sheet. Alternatively, the figure used can



be the average shareholder's equity, which is calculated by taking the average of the shareholder's equity for the beginning and the end of the fiscal period. It is generally more accurate to use average shareholder's equity for the denominator since the ratio compares an income statement item (which lists data over a period of time) to a balance sheet item (which lists financial data for a point in time).

Investors analyze ROE against historical trends and industry benchmarks. A rising ROE signals that the firm is earning more profits from its net assets relative to previous years. In addition, a firm generating a level of ROE in excess of industry norms is likely more efficient at generating earnings than its peers. Generally speaking, a higher ROE is a positive sign. However, simply looking at the ROE paints an incomplete picture.

As stated previously, ROE is a measure of company or management efficiency. Yet, each company has its own unique circumstances. For example, since ROE measures net income against shareholder's equity, it does not take into account company assets funded by raising debt. As I previously pointed out in this series on financial statement analysis, a company can raise capital either through shareholders by issuing additional equity or by issuing additional debt through bonds or notes. (See "The Cash Flow Statement: Tracing the Sources and Uses of Cash" in the July 2012 *AAII Journal*.) By issuing additional debt to fund a project, a company is able to increase its ROE if the project is profitable since no

additional equity was issued, causing net income to increase without any increase in shareholder's equity. The key point is that profit generated by using additional debt must exceed the cost of funding, or the interest payments. This process is known as leverage. Alternatively, a firm may retire outstanding shares by issuing debt, thereby causing the ROE figure to increase again without really creating additional firm value.

Therefore, by simply looking at ROE, one is not able to tell the underlying drivers for an increase or decrease in ROE. For this reason, the DuPont formula was created.

The DuPont Formula

The DuPont formula breaks down ROE into three distinct elements—profitability, efficiency and financial leverage. The formula is used by investors to compare and analyze the source of a company's ROE compared to historical trends or other companies in similar industries. The DuPont formula breaks down ROE as follows:

$$\text{ROE} = \text{net profit margin} \times \text{asset turnover} \times \text{equity multiplier}$$

Alternatively, the DuPont formula can be written as follows:

$$\text{ROE} = (\text{net profit} \div \text{sales}) \times (\text{sales} \div \text{assets}) \times (\text{assets} \div \text{equity})$$

Though a company can increase its ROE by taking on additional leverage, it is generally more desirable for firms to increase their margins or turnover.

Net profit margin

Net profit margin is calculated by dividing net income by sales. Simply put, this margin shows the net profits that a firm earns for each dollar of sales it generates after the costs of producing and selling goods, overhead expenses,

interest and taxes are accounted for. The margin is a representation of a firm's pricing strategy and depends on several key factors.

Needless to say, companies try to find the optimal price point for their products and services; one that maximizes profits. The higher at which the price is set, the lower the sales volume will be, and vice versa. From an economics standpoint, the price should be set at a level where price multiplied by volume is the greatest. Of course, reality is much more complicated.

Profit margins are usually a direct result of competition that a company faces. In highly competitive industries, profit margins tend to be lower. Industries with products that have very little differentiation, which are commonly known as commodity products, are not able to achieve high profit margins. A good example of such companies is grocery stores. There is little differentiation between products. A shopper will choose a convenient store that has

the lowest price on Tide or Cheerios. Companies operating in industries with low barriers to entry will also see their margins erode as new companies jump into the fray. An example is the electronics industry, where low-cost producers have driven down the price of television sets, while traditional brick-and-mortar retailers are losing market share to online competitors.

In contrast, companies able to sustain higher profit margins offer a differentiated, or "one-of-a-kind," product. These companies face decreased competitive pressures and often operate in industries with high barriers to entry. These companies tend to create products with high intellectual property value or on which they own patents. Firms in these industries generally compete on product quality, features and innovation.

Asset turnover

The asset turnover ratio is calculated by dividing sales by total assets. The ratio is a measure of how efficiently manage-

Table 1. Historical Analysis of ROE Using DuPont Formula

Example data comes from the income statement, balance sheet and cash flow statement found in the Financial Statement Analysis columns in the March, May and July 2012 issues of the *AAII Journal*, which are linked to this table online.

Dollar amounts are in millions of dollars.

Year 2011

Net profit margin	= net income ÷ sales
	= \$82.75 ÷ \$1,000 = 8.275%
Asset turnover ratio	= sales ÷ assets
	= \$1,000 ÷ \$1,485 = 0.673
Equity multiplier	= assets ÷ equity
	= \$1,485 ÷ \$418 = 3.553
ROE	= net profit margin × asset turnover ratio × equity multiplier
	= 0.08275 × 0.673 × 3.553 = 19.8%

Year 2010

Net profit margin	= net income ÷ sales
	= \$63.25 ÷ \$800 = 7.906%
Asset turnover ratio	= sales ÷ assets
	= \$800 ÷ \$1,297 = 0.617
Equity multiplier	= assets ÷ equity
	= \$1,297 ÷ \$290 = 4.472
ROE	= net profit margin × asset turnover ratio × equity multiplier
	= 0.07906 × 0.617 × 4.472 = 21.8%

Table 2. Competitive Analysis of ROE Using DuPont Formula

Dollar amounts are in millions of dollars, based on fiscal-2011 financial statement data.

Apple Inc. (AAPL)

Net profit margin	= net income ÷ sales
	= \$25,922 ÷ \$108,249 = 23.947%
Asset turnover ratio	= sales ÷ assets
	= \$108,249 ÷ \$95,777 = 1.130
Equity multiplier	= assets ÷ equity
	= \$95,777 ÷ \$62,203 = 1.540
ROE	= net profit margin × asset turnover ratio × equity multiplier
	= 0.23947 × 1.130 × 1.540 = 41.7%

Hewlett-Packard Co. (HPQ)

Net profit margin	= net income ÷ sales
	= \$7,074 ÷ \$127,245 = 5.559%
Asset turnover ratio	= sales ÷ assets
	= \$127,245 ÷ \$127,010 = 1.002
Equity multiplier	= assets ÷ equity
	= \$127,010 ÷ \$39,537 = 3.212
ROE	= net profit margin × asset turnover ratio × equity multiplier
	= 0.05559 × 1.002 × 3.212 = 17.9%

ment is able to drive sales from company assets. For the most part, volume is not as critical for higher-margin companies as it is for lower-margin companies since each sale is more profitable. Higher-margin companies are able to generate the same absolute dollar of earnings with lower sales volume.

On the other hand, lower-margin firms need higher sales volume to achieve the same net income. In order for these companies to generate growth in earnings, they need the additional sales volume since their products lack differentiation and they compete on the basis of price.

Equity multiplier

The final component of the DuPont formula is the equity multiplier. This is calculated dividing assets by shareholder's equity. This ratio measures the amount of debt a firm uses, or its leverage. Basic accounting tells us that assets are equal to liabilities plus shareholder's equity. Therefore, the higher the ratio, the more debt the company employs in relation to shareholder's equity.

Issuing more debt enables a com-

pany to raise its ROE by increasing its equity multiplier. Conceptually, it is easy to see how this works. Firms can fund additional projects using debt instead of additional equity. If the project is able to generate more sales than the interest payments required to service the additional debt, ROE is increased as additional profits are generated without additional shareholder's equity funding. However, a firm can become overburdened with debt if it is unable to keep up with interest payments, and it may be forced into bankruptcy.

Analysis of the DuPont Formula

Table 1 provides calculations for the DuPont formula components using the financial statements provided in the first three installments of the Financial Statement Analysis series. For simplicity's sake, the ROE figure is calculated by using the ending shareholder's equity, which is found on the balance sheet. The sample company's ROE dropped from 21.8% in 2010 to 19.8% in 2011. At first glance, the decrease in ROE is a signal that company management has

become less efficient in generating income using shareholder's equity. The company was able to generate \$0.218 of income per dollar of shareholder's equity in 2010, but was only able to generate \$0.198 per dollar of equity in 2011. Using the DuPont formula provides a clearer story, however.

Breaking down ROE into DuPont formula components shows that the firm's net profit margin increased from 7.9% in 2010 to 8.3% in 2011. The firm also increased its asset turnover ratio from 0.62 in 2010 to 0.67 in 2011. ROE decreased due to significant deleveraging by the firm, with its equity multiplier decreasing from 4.47 in 2010 to 3.55 in 2011. These figures suggest that during 2011, the firm was able to generate higher margins while increasing volume of sales for each unit of asset held, both of which indicate higher man-

agement efficiency. The reason for the firm's decrease in ROE was due to the firm using proportionately less debt in relation to shareholder's equity.

By most accounts, an ROE of 20% is considered good, but it is much harder to assess the strength of each individual component without comparing them to industry norms or a competitor. To show how industry analysis can be applied, I used the financial statements from AAI's *Stock Investor Pro* stock screening program for computer hardware companies Apple Inc. (AAPL) and Hewlett-Packard Co. (HPQ). *Stock Investor Pro* calculates ROE by using average shareholder's equity, which is thought of as a more accurate assessment.

Table 2 shows significant differences between Apple's and Hewlett-Packard's figures. Apple's ROE is 41.7%, while Hewlett-Packard's is 17.9%. In 2011, the median ROE for the computer hardware industry was 10.7%. This shows that Hewlett Packard has a strong ROE in relation to the industry median, but Apple's ROE is still much higher. A further breakdown sheds more light.

Apple has a net profit margin of

23.9% compared to a net profit margin of 5.6% for Hewlett-Packard. For every dollar of sales that Apple generates, it is able to create almost \$0.24 of net profit for its shareholders. On the other hand, Hewlett-Packard is able to only generate \$0.06 per dollar of sales. Why is there such a large discrepancy between the two firms? As stated previously, firms with high margins tend to exhibit several characteristics, such as operating in industries with high barriers to entry and offering highly differentiated products. Barriers to entry in the computer hardware industry are similar for both firms. However, the similarities end there. Apple's main product lines—the Mac, iPhone and iPad—are highly differentiated products compared to Hewlett-Packard's. The difference is even more extreme for an iPad and an iPhone when compared to other tablets and phones, though competitors are starting to catch up.

On the other hand, Hewlett-Packard's profit margin is more indicative of a company that offers products with less competitive advantages. For the typical consumer buying an everyday laptop, there isn't a significant difference between a Hewlett-Packard and a Dell. The consumer would most likely purchase the cheaper laptop, if the specifications were the same for each. In other words, these companies' computers are closer to commodity products than differentiated products that customers are willing to pay a premium for.

There is not much difference in Apple's and Hewlett-Packard's asset turnover ratios, both of which are close to 1.00. Apple's asset turnover ratio is marginally higher, which shows that the company is slightly more efficient at driving sales using its assets.

Hewlett-Packard utilizes long-term debt, whereas Apple does not, choosing instead to rely on its large cash balance. The difference can be seen in the equity

Table 3. Extended DuPont Formula

Dollar amounts are in millions of dollars, based on fiscal-2011 financial statement data.

Apple Inc. (AAPL)

Tax efficiency	= net income ÷ pretax profit
	= \$25,922 ÷ \$34,205 = 75.784%
Interest efficiency	= pretax profit ÷ EBIT
	= \$34,205 ÷ \$34,205 = 100%
EBIT profit margin	= EBIT ÷ sales
	= \$34,205 ÷ \$108,249 = 31.598%
Asset turnover ratio	= sales ÷ assets
	= \$108,249 ÷ \$95,777 = 1.130
Equity multiplier	= assets ÷ equity
	= \$95,777 ÷ \$62,203 = 1.540
ROE	= 0.75784 × 1.0 × 0.31598 × 1.130 × 1.540 = 41.7%

Hewlett-Packard Co. (HPQ)

Tax efficiency	= net income ÷ pretax profit
	= \$7,074 ÷ \$8,982 = 78.758%
Interest efficiency	= pretax profit ÷ EBIT
	= \$8,982 ÷ \$9,677 = 92.818%
EBIT profit margin	= EBIT ÷ sales
	= \$9,677 ÷ \$127,245 = 7.605%
Asset turnover ratio	= sales ÷ assets
	= \$127,245 ÷ \$127,010 = 1.002
Equity multiplier	= assets ÷ equity
	= \$127,010 ÷ \$39,537 = 3.212
ROE	= 0.78758 × 0.92818 × 0.07605 × 1.002 × 3.212 = 17.9%

multipliers of 3.21 for Hewlett-Packard and 1.54 for Apple.

Extended DuPont Formula

The extended DuPont formula consists of five components instead of three. The main difference between the original DuPont formula and the extended DuPont formula is that the extended formula breaks down net profit margin to show the effects of taxes and interest on ROE, which can be very important in company analysis. The original formula showed that companies are able to boost their ROE by becoming more leveraged. Eventually companies that take on additional debt will reach a point where the cost of debt will diminish profit margins. The formula can be written as follows:

$$\text{ROE} = \text{tax burden} \times \text{interest burden} \times \text{EBIT}$$

profit margin × asset turnover × equity multiplier

Alternatively, the DuPont formula can be written as follows:

$$\text{ROE} = (\text{net income} \div \text{pretax profit}) \times (\text{pretax profit} \div \text{EBIT}) \times (\text{EBIT} \div \text{sales}) \times (\text{sales} \div \text{assets}) \times (\text{assets} \div \text{equity})$$

For analysis purposes, we once again compare Apple and Hewlett-Packard. Calculations are shown in Table 3.

The tax efficiency ratio simply measures the effect of taxes on a company's net income. The figure can be calculated as one minus the tax rate. (For example, the tax efficiency ratio for a firm paying the 35% corporate tax rate is 0.65, or 1 – 0.35.) Apple's tax efficiency ratio is lower than Hewlett-Packard's, showing that Apple pays more taxes as a percentage of pretax profits than Hewlett-Packard

does. The ratio can be manipulated by the tax breaks and deductions a particular firm is able to claim.

The interest efficiency ratio measures the effect of interest on ROE. A higher borrowing cost lowers pretax profit, therefore creating a lower ROE. You may also use operating income as the denominator in this ratio to measure the effect of both interest and non-operating expense. If you choose to use operating income in this ratio, be sure to stay consistent and use operating income in the EBIT margin ratio. Apple's interest efficiency ratio is 100%, meaning that they have no interest expense, while Hewlett-Packard's interest efficiency ratio is 93%. (Hewlett-Packard's interest expense was found using the company's 2011 annual report.) This may be one of the reasons why Hewlett-Packard has a lower tax rate, since interest reduces taxable earnings. The long-term debt that Hewlett-Packard holds enables the

company to have a higher tax efficiency ratio at the expense of a lower interest efficiency ratio.

The third ratio in the formula measures the effect of earnings before interest and tax (or EBIT margin) on ROE. This ratio evaluates the effect of a company's core business operations on its final return on equity. It measures how much EBIT a firm can generate given a unit of sales. Apple's EBIT margin is 31.6%, while Hewlett-Packard's EBIT margin is a respectable 7.6%. Once again, the high margin can be attributed to Apple's ability to produce differentiated products. The final two components, asset turnover and the equity multiplier, are the same for both the traditional and the extended DuPont formula.

Conclusion

ROE is one of the most widely used profitability ratios, providing a quick

measure of management efficiency and a company's ability to generate net income through shareholder's equity.

Through the use of DuPont analysis, investors are able to determine the actual drivers behind a company's ROE. The DuPont formula allows you to ascertain if a company has been able to effectively use debt to drive stronger profits as well as how margins and asset turnover are trending over time. Be sure to compare ROE and its drivers to other companies in the same industry rather than against all companies. Any outliers should be closely examined. An abnormally high margin or turnover is hard to maintain, while an unusually low margin or turnover may signal financial difficulties ahead.

The DuPont formula provides insight on a firm's strengths and weakness, which may give you, as an investor, a better idea of what to look for when performing fundamental analysis. ▲

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Financial Planning

(continued from page 19)

Making Good Better

A potential criticism of the RMD rule is that it results in relatively low consumption early in retirement. While this outcome might be optimal for some households, particularly those fearful of rising health care costs, others might prefer greater consumption at younger ages when they are better able to enjoy it. This result could be achieved by a modification to the RMD rule, namely to consume interest and dividends (but not capital gains), plus the RMD percentage of financial assets. To illustrate, a 65-year-old couple with financial assets of \$102,000 who received \$2,000 of interest and dividends in the last year, would spend \$5,130: the \$2,000 in

interest and dividends, plus 3.13% (the annual withdrawal percentage at age 65 under the RMD strategy) of \$100,000. In contrast, a household following the unmodified RMD rule would spend just \$3,130.

Figure 3 compares the SEW of the modified RMD strategy with the SEWs of the strategies reported in Figure 2. At a factor of 1.03, it outperforms all the alternatives, including the unmodified RMD rule. The disadvantage of the modified RMD rule is its greater complexity. Although 401(k) and IRA statements report interest and dividends, households must extract this information and perform the necessary calculations to determine their withdrawal amount. One solution might be for 401(k) and IRA statements to report

the amount available for spending under the modified RMD rule.

Conclusion

Rather than attempt the complex calculations necessary to arrive at an optimal strategy for drawing down and spending their retirement savings, retirees rely on easy-to-follow rules of thumb, such as the 4% rule advocated by some financial planners. This article suggests that the IRS' required minimum distribution rules may be a viable alternative.

For financial and practical reasons, the effectiveness of the alternative RMD strategy compares favorably to traditional rules of thumb. And a modified RMD strategy does even better. ▲

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