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"Key Financial Metrics - The DuPont Model"

Critical Equation #3 for Business Leaders

$$\frac{\text{Net Income}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Assets}} = \frac{\text{Net Income}}{\text{Assets}} \times \frac{\text{Assets}}{\text{Equity}} = \frac{\text{Net Income}}{\text{Equity}}$$

Overview

A prerequisite for business leaders at all levels of an organization is the ability to make comparisons of financial data. These comparisons are typically made to time (trend analysis), to competitors (competitive analysis), or to a plan (variance analysis). Being able to draw insight from comparative data is essential to making decisions under uncertain conditions such as limited information, time pressure, divergent opinions, and limited resources. Drawing insight from financial data requires understanding the drivers of return on equity found in our equation #3. Understanding how we can impact these drivers from an operational perspective is central to creating short- and long-term shareholder value.

The primary accounting tool, applicable across all industries, is the DuPont Model. Most importantly, the DuPont Model requires business leaders to be responsible for both the income statement and balance sheet (we will recognize the criticality of cash flow in due course). The DuPont Model, of course, is not without criticism, and we do not argue for its being the sole driver of business decisions. Its application must be balanced with the potential negatives we will discuss along with an understanding that no model can capture in its entirety the economic reality of every business. While numerous authors argue that use of the DuPont Model has eroded, we have seen no evidence of this across our many clients. In fact, we will demonstrate that a modified version of the standard DuPont Model that incorporates financial leverage can help explain the significant deterioration of many businesses during the recent global recession, in particular financial services.

History of DuPont Model

The DuPont Model is credited to F. Donaldson Brown, an engineer by education who attempted to put some scientific rigor into the measurement of financial performance almost a century ago at DuPont, the chemical giant of its day. Many authors also cite Brown's contribution to the early success of GM, with more than 20% DuPont ownership at the time. Its successful application as a planning and control system at GM and DuPont was well received, and it was put to use in the daily operations of most major corporations.

TRI'S Critical Equation # 3

The modified version of the DuPont formulation is:

$$\frac{\text{Net Income}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Assets}} = \frac{\text{Net Income}}{\text{Assets}} \times \frac{\text{Assets}}{\text{Equity}} = \frac{\text{Net Income}}{\text{Equity}}$$

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To begin to appreciate the formulation, imagine that the only information you have is given in Exhibit 1.

Exhibit 1

Financial Statements & Measurements

| | | | | | |
|---|--|--------|------|--|--------|
| Income Statement Sales - Costs <hr/> Net Income* *ESP=Net Income/# of Shares | Balance Sheet <hr/> <table border="1" style="width: 100%;"> <tr> <td style="width: 50%;">Assets</td> <td style="width: 50%;">Debt</td> </tr> <tr> <td></td> <td style="text-align: center;">Equity</td> </tr> </table> | Assets | Debt | | Equity |
| Assets | Debt | | | | |
| | Equity | | | | |

Question

What Financial Metrics can we calculate with the available information above to measure our performance? You do not know the breakdown of either the Costs or Assets.

An alternative to this question is “If you had to design a system to measure your performance that you would be accountable for and possibly incentivized on, what might those measurements be, given the lack of breakdown of costs and assets?”

Five fundamental ratios would fall out of the analysis. These are given in Exhibit 2.

Exhibit 2

Financial Statements & Measurements

Financial Statements

| | | | | | |
|---|--|--------|------|--|--------|
| Income Statement Sales - Costs <hr/> Net Income* *ESP=Net Income/# of Shares | Balance Sheet <hr/> <table border="1" style="width: 100%;"> <tr> <td style="width: 50%;">Assets</td> <td style="width: 50%;">Debt</td> </tr> <tr> <td></td> <td style="text-align: center;">Equity</td> </tr> </table> | Assets | Debt | | Equity |
| Assets | Debt | | | | |
| | Equity | | | | |



Financial Measurements*

| | | | | | | | | |
|--|---|----------------------|---|---------------------------|---|-----------------------|---|---------------------------|
| Return on Sales | x | Asset Turnover** | → | Return on Assets*** | x | Financial Leverage | → | Return on Equity**** |
| ↓ Net Income Sales | | ↓ Sales Assets | → | ↓ Net Income Assets | | ↓ Assets Equity | → | ↓ Net Income Equity |
| Cost Efficiency x Asset Efficiency → Business Efficiency x Capital Structure → Stakeholder Return | | | | | | | | |
| <small>*Assets & Equity @ Average Values ** Working Capital Turnover = Sales/Receivables + Inventory - Payables - Progress Connections *** Return on Total Capital (ROTC) = (Net Income + After-Tax Cost of Interest)/Total Capital (Interest Bearing Debt + Equity + Minority Interest) **** Return of Equity x Price-to-Earnings Ratio = Market Capitalization to Book Equity</small> | | | | | | | | |

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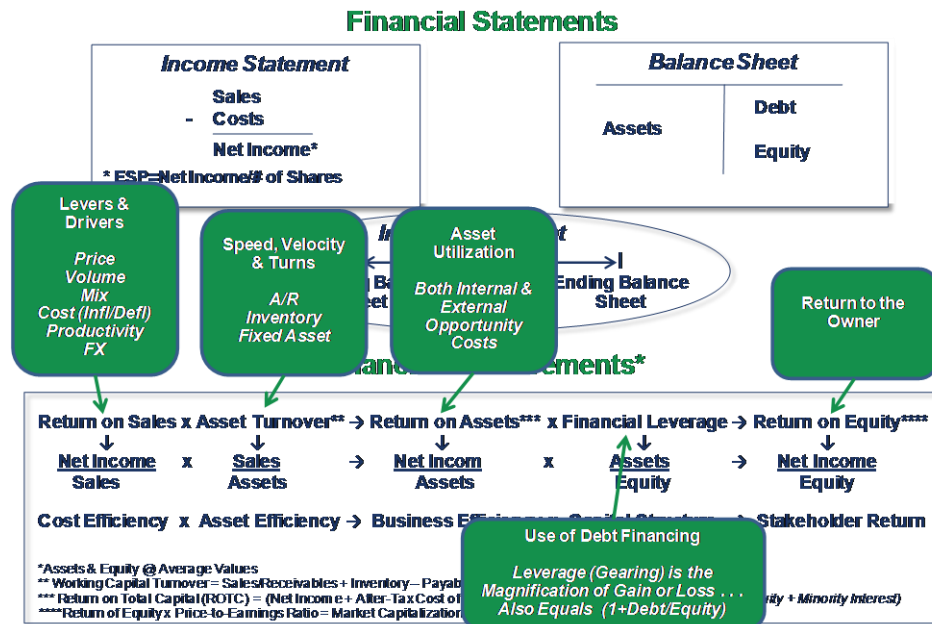
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The five financial ratios are Return on Sales (ROS), Asset Turns, Return on Assets (ROA), Financial Leverage, and Return on Equity (ROE).

The original DuPont Model is actually Return on Sales multiplied by Asset Turns equals Return on Assets. Exhibit 3 depicts these primary drivers.

Exhibit 3

Financial Statements & Measurements



From a management perspective, the primary benefits of understanding the DuPont Model are the trend and competitive analysis and understanding their drivers, some controllable, some not controllable depending on the industry. Variance analysis (prior year to plan, plan to actual, and prior year to actual) are the topic of TRI's Critical Equations #1 and # 2 (see prior newsletters and/or www.tri-simulation.com).

Return on Sales (of after-tax profit margin) can be deconstructed into other margins such as contribution margin, operating margin, gross margin, EBIT, or EBT. Similarly, Asset Turns can be divided into working capital turns, receivable turns, inventory turns, and fixed asset turns. Financial Leverage, or Gearing Ratio as it is often referred to outside the U.S., magnifies the gains or losses associated with ROA. Operating Leverage is the percentage change in operating profit divided by the percentage change in sales.

The key driver of operating leverage is the ratio of fixed to variable costs. An increase in fixed relative to variable costs will result in greater operating leverage with a commensurate increase in risk. The risk derives from declines in sales against the fixed cost. High degrees of Operating Leverage coupled with Financial Leverage, often seen in industries such as automobile manufacturing and hotels, can be risky, depending on the volatility of drivers such as price, volume, etc. Public utilities have significant Operating and Financial Leverage, but regulation plus low elasticity of demand mitigate to some degree the combined potential negative leverage.

Most of the volatility in ROE over time typically comes from change in the margin (Asset Turns and Financial Leverage tend to be more stable across time for most industries). When low on ROS, most industries tend to be high

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on Asset Turns. Grocery stores, for example, have low margins due to competition but are profitable because of volume. Or the after-market can provide the profitability in lower margins on initial sale. A converse example is a business producing diesel electric locomotives, which has significant margins over the product life cycle with lower turns due to capital intensity and lower volumes. As a test, check out the inventory turns in a business that produces a very complex product like an airplane.

Sustainability and differentiation are fundamental to business strategy. No business that can sustain high ROA indefinitely. Businesses that come close have both t (high margins) and f (volume). Consistent excess returns, however, eventually attract others, be it competition or a regulatory body. Because of the “human factor,” organizational success often results in a resistance to change or worse, institutional arrogance. An industry with consistently high ROAs is pharmaceuticals, at least historically. How about Google over the next decade?

Test your knowledge of industry dynamics and the DuPont Model in Exhibit 4. Which business is in Manufacturing? Which is the Financial Service business? Note: the ROE is identical while how we got there may be significantly different.

Exhibit 4

Manufacturing vs. Financial Services

Financial Measurement Industry Comparison*

| | Return on Sales ↓ $\frac{\text{Net Income}}{\text{Sales}}$ | x | Asset Turnover ↓ $\frac{\text{Sales}}{\text{Assets}}$ | → | Return on Assets ↓ $\frac{\text{Net Income}}{\text{Assets}}$ | x | Financial Leverage ↓ $\frac{\text{Assets}}{\text{Equity}}$ | → | Return on Equity ↓ $\frac{\text{Net Income}}{\text{Equity}}$ |
|----|--|---|---|---|--|---|--|---|--|
| A) | 6% | x | 2 | → | 12% | x | 1.5 | → | 18% |
| B) | 20% | x | .15 | → | 3% | x | 6 | → | 18% |

* Representative only

Manufacturing vs. Financial Services

Which one is A)? Why?

With significant margins and low degrees of financial leverage, A is Manufacturing. Financial Services, due to intense competition in pricing, have much lower ROAs (often called ROYs) but make significant use of borrowed monies or leverage. Think about our recent experience. Increases in defaults on all classifications of loans layered on top of little equity leaves little margin for error. Of course, this is at the heart of Basel II and potential financial regulation being debated by Congress. Numerous websites and textual materials are available that will compare, from a DuPont perspective, both within and amongst industry comparisons. Another interesting application of the DuPont Model is with the so-called ISO-ROA maps. The prime advantage of the ISO-ROA application is the ease of seeing within and amongst industry comparisons and/or across time within an organization in a graphical form.

An Example

One application of financial measures in the DuPont Model is to look at data trends to understand the drivers of any positive or negative change. In Exhibit 5, complete the boxes given the financial time series. Do you like this

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business? Would you buy this business? While this is not a complete due diligence, based on the ROS, Asset Turns and ROA, what inference can you draw?

Exhibit 5

Income Statements & Financial Ratios

| | Year 1 | Year 2 | Year 3 |
|-----------------|--------------|--------------|--------------|
| Sales | \$100 | \$140 | \$200 |
| Costs | -95 | -126 | -170 |
| Earnings | \$5 | \$14 | \$30 |
| Assets | \$100 | \$125 | \$160 |

| | Year 1 | Year 2 | Year 3 |
|--------------------------|----------------------|----------------------|----------------------|
| Return on Sales (ROS) ⇒ | <input type="text"/> | <input type="text"/> | <input type="text"/> |
| Asset Turnover (TURNS) ⇒ | <input type="text"/> | <input type="text"/> | <input type="text"/> |
| Return on Assets (ROA) ⇒ | <input type="text"/> | <input type="text"/> | <input type="text"/> |

Naturally, all of us would have expected and required additional information. In Exhibit 6, note how the growth rates can be linked to the financial ratios. While the example is magnified because of the low base of \$5 earnings in Year 1, we can see that having the next level of margin grow at a faster rate than the prior level is critical in an income statement. Imagine an income statement with variable and fixed costs. With variable cost productivity, the contribution margin grows at a faster rate than sales. With fixed cost productivity, the operating margin grows at a faster rate than the contribution margin. This is the classic example of Operating Leverage.

Exhibit 6

Income Statements & Financial Ratios

| | Year 1 | Year 2 | Year 3 | Growth Rate (1-3) |
|-----------------|--------------|--------------|--------------|-------------------|
| Sales | \$100 | \$140 | \$200 | 100% |
| Costs | -95 | -126 | -170 | 79% |
| Earnings | \$5 | \$14 | \$30 | 500% |
| Assets | \$100 | \$125 | \$160 | 60% |

| | Year 1 | Year 2 | Year 3 |
|--------------------------|--------|--------|--------|
| Return on Sales (ROS) ⇒ | 5% | 10% | 15% |
| Asset Turnover (TURNS) ⇒ | 1x | 1.12x | 1.25x |
| Return on Assets (ROA) ⇒ | 5% | 11.2% | 18.75% |

Would you buy this company?

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However, the balance sheet in Exhibit 7 reveals a cash flow issue that might not be obvious in Exhibit 6 and, from a market value perspective, a lack of quality of earnings, and a disconnect in net income and cash flow. This demonstrates the importance of drilling down and taking cash flow into account.

Exhibit 7

Balance Sheets

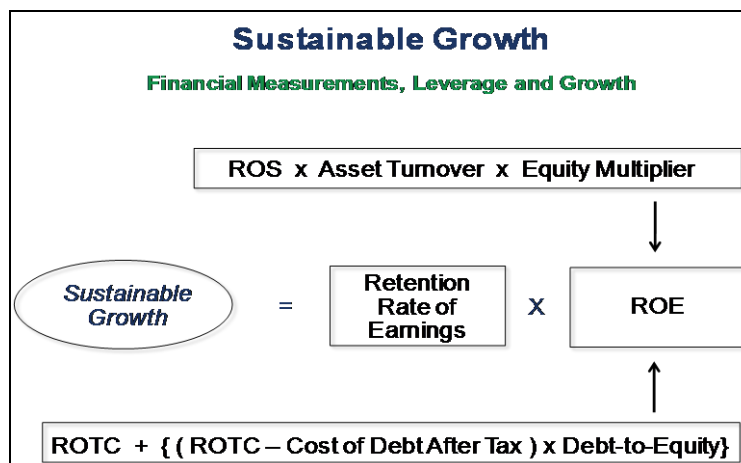
| Sales | \$100 | \$140 | \$200 | 100% |
|------------------------|--------------|--------------|--------------|------|
| | Year1 | Year2 | Year3 | |
| Cash | \$30 | \$15 | \$2 | -93% |
| Receivables | 20 | 40 | 60 | 200% |
| Inventory | 10 | 25 | 48 | 380% |
| Plant/Equipment | 40 | 45 | 50 | 25% |
| Total Assets | \$100 | \$125 | \$160 | |
| | Year1 | Year2 | Year3 | |
| Debt | \$50 | \$61 | \$66 | |
| Equity | 50 | 64 | 94 | |
| Debt and Equity | \$100 | \$125 | \$160 | |

Where is the cash?

DuPont Model, Leverage and Growth

The concept of sustainable growth often is applied to the market valuation of equity and other long-term investments. When calculating value in Discounted Cash Flow models, a sustainable growth rate often is used for the benefit of simplicity. Sustainable growth is the maximum growth in net income we can achieve given assumptions on margins, turns, and financial leverage (referred to as the equity multiplier in Exhibit 8). An alternative arrangement of the DuPont Model with financial leverage is at the bottom of Exhibit 8 (we will gladly supply a derivation upon request). This variation is framed in terms of a new financial metric called Return on Total Capital or ROTC. ROTC is the net operating profit after tax (unlevered net income or NOPAT) divided by the total capital (sum of shareholders equity and interest-bearing debt). Sustainable growth is the product of the retention rate of earnings (percentage of net income reinvested in the business or one minus the payout ratio for dividends) and ROE.

Exhibit 8



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With an ROE of 15% and a retention rate of earning of 60%, the sustainable growth is 9%. If we assume, for the merit of simplicity, that the price-to-earnings ratio was constant over time, share price would increase at the annual rate of 9%. The total shareholder return would be the sum of the 9% plus the dividend yield.

Positives and Negatives of DuPont in Practice

The positives of applying a DuPont formulation as a business leader are:

1. Simplicity of use and communication
2. Linkage of income statement and balance sheets
3. Allows for comparisons to time (trend), competition (differentiation) and plan (execution risk)
4. Potential link to compensation (again with an understanding of cash flow)
5. From a risk perspective, see operational drivers -- some controllable, some not

The negatives, as we see it, are:

1. Accounting-based system with valuation primarily from an historical perspective,
2. No linkage to the cost of capital
3. Limited correlation to cash flow
4. No direct linkage to non-financial metrics unless specifically defined
5. Inability to apply at business unit and/or product line levels due to lack of balance sheet drill down
6. Accounting treatments may vary across the world so one needs to be careful with comparisons

Summary

Having survived nearly a century of application and debate, some positive and some negative, the DuPont Model can provide business leaders at all levels insight to understand fundamental drivers of profitability and return on investment. From TRI's perspective, we believe the model has the merit of simplicity, allows everyone in an organization to understand what they can influence when the income statement and balance sheet are properly detailed, and, from a risk management perspective, enables the applications of variance analysis discussed in our other business equations. As we've stated, no model can capture all aspects of business reality and must be viewed in a systems perspective of other models. If you have questions or want more information on any of our business equations, please contact us at TRIContact@tri-simulation.com.

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