3M's Race to the Tape

Jim McNerney is the Chairman and CEO of 3M. He is the first outsider to take the reins of 3M in its century-long history. McNerney joined 3M after losing a three-way race to succeed John F. Welch as chief executive of General Electric.

3M is a mini-GE in many respects. Both companies are industrial conglomerates that seek to balance slowdowns in one industry with upturns in others. Both companies also have strong traditions of discipline, quality, and a focus on measuring and rewarding performance. 3M has produced several world-famous brands such as Scotch® tape and Post-it® notes. Still, 3M is primarily a nuts-and-bolts type producer. It provides duct tape, turbines, and electronic gear that keep the industrial world humming.

The key to 3M's success is its research. Over the decades, 3M scientists and engineers have developed sandpaper, magnetic audiotape, molds and glues for orthodontia, lime-yellow traffic signs, respirators, floppy disks, and Scotchgard™. To this day, 3M draws its identity from its research success. 3M devotes more than $1 billion to research each year and has 1,000 scientists and engineers around the world searching for the next breakthrough.

Income has increased 35% since McNerney took control in 2001. 3M's income for 2003 topped off at $2.4 billion on sales of $18.23 billion, yielding a 13.2% net profit margin. Importantly, its return on equity (ROE), as shown below and defined as net income/average equity, has continued to climb since 2001, when restructuring costs cut into 3M's income as the new CEO refocused activities.
3M’s increase in ROE has been accompanied by a steady increase in its stock price. By early 2005, 3M shares were valued at just over $82 per share, which is 35% higher than when McNerney took control. The Dow Jones Industrial Average, by contrast, shows no net (percent) increase for the same time period.

What is McNerney’s secret? There is no doubt that one of McNerney’s most urgent problems at 3M was its ballooning costs. Costs had grown at twice the rate of sales in the years prior to his arrival. McNerney’s cost-control efforts generated an immediate savings of $500 million in 2001. That same year, he also streamlined purchasing, which generated another $100 million in savings.

One key to cost savings at 3M is its Six Sigma cost-cutting program, which was successfully applied at GE and a number of other companies now led by former GE executives. 3M is using Six Sigma for everything from focusing sales efforts to developing new kinds of duct tape.

McNerney’s efforts are paying off. In 2003, sales rose in each of 3M’s businesses except telecom, and income was up in all but the industrial division. Further, cash flows swelled by 29%, to $3.79 billion, and 3M’s

(Continued on next page)
operating income margin widened by a full percentage point to nearly 21%. 3M also increased its inventory turnover, which contributed greatly to its increases in cash flows and profitability.

McNerney has also increased acquisitions by 3M. He hopes to use acquisitions to help grow sales 10% annually, nearly double the rate of the past decade. Fortunately for McNerney, 3M has the cash flows and the flexibility necessary to go shopping.

3M has funded its cash outflows for acquisitions in part with cash inflows from improved working capital management. For example, 3M’s average collection period for its receivables has been reduced from 63 days in 1999 to 52 days in 2003. Increased production efficiencies and lower cost raw materials have boosted inventory turnover from 3.8 times per year to 5.0 times since McNerney took control. As a result, the working capital needed to run 3M has declined as a percent of sales, boosting both income and cash flows.

3M’s management has brought operating discipline to the business, including a renewed focus on measures used to evaluate financial performance. This module focuses on such measures. A key to company success is ROE. This module explains ROE and focuses on disaggregation of ROE, also called DuPont analysis (after DuPont management that first successfully applied it). ROE disaggregation focuses on the drivers of ROE. This module also introduces liquidity and solvency analysis—another important aspect of company success. Specifically, we describe the factors relevant to credit analysis and its use in setting debt ratings and terms.


INTRODUCTION

Effective financial statement analysis and interpretation begin with an understanding of the kinds of questions that are both important and can be aided by financial analysis. Then, determining which questions to ask is a function of the type of analysis we plan to conduct. Different stakeholders of a company have different analysis requirements. Consider the following:

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Types of Questions Guiding Analysis of Financial Statements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Creditor</td>
<td>Can the company pay the interest and principal on its debt? Does the company rely too much on nonowner financing?</td>
</tr>
<tr>
<td>Investor</td>
<td>Does the company earn an acceptable return on invested capital? Is the gross profit margin growing or shrinking? Does the company effectively use nonowner financing?</td>
</tr>
<tr>
<td>Manager</td>
<td>Are costs under control? Are company markets growing or shrinking? Do observed changes reflect opportunities or threats? Is the allocation of investment across different assets too high or too low?</td>
</tr>
</tbody>
</table>

A crucial aspect of analysis is identifying the business activities that drive company success. Namely, does company return on invested capital result from operating activities or nonoperating (often called financial) activities? The distinction between operating and nonoperating activities is important as it plays a key role in effective analysis.

Operating activities are the core activities of a company. They are the activities required to deliver a company’s products or services to its customers. Operating activities include research and development of products, the establishment of supply chains, the assemblage of administrative and productive product support, the promotion and marketing of products, and after-sale customer services.

Operating activities are reflected on the balance sheet, for example, by receivables and inventories net of payables and accruals, and by long-term operating assets net of long-term operating liabilities. On the income statement, operating activities are reflected in revenues, costs of goods sold, and operating expenses such as selling, general, and administrative expenses. Operating activities have the most long-lasting (persistent) effects on the future profitability and cash flows of the company and, thus, are the primary value drivers for company stakeholders. It is for this reason that operating activities play such a prominent role in effective profitability analysis.

Nonoperating activities primarily relate to the investing and financing activities of a company. They are reflected on the balance sheet as nonoperating (financial) assets and liabilities, which expand and contract as a buffer to fluctuations in operating asset and liability levels. When operating assets grow faster than operating liabilities, nonoperating liabilities must increase to finance them (per the accounting equa-
tion). These liabilities contract when assets decline and can even turn negative, resulting in financial assets invested temporarily in marketable securities to provide some return until those funds are needed again for operations. On the income statement, nonoperating activities are reflected in expenses and revenues from those financial liabilities and assets. Although nonoperating activities are important and must be carefully managed, they are not the value drivers.

Module 1 introduced a simple measure of financial performance called return on assets (ROA), defined as net income divided by average total assets. ROA is a widely quoted measure and, for that reason, it is one we should know. Net income in the ROA formula, however, is an aggregation of both operating and nonoperating components. Accordingly, it fails to distinguish between these two important activities and drivers of company performance. Likewise, total assets combine both operating and nonoperating assets and liabilities. Effective analysis segregates operating and nonoperating activities and, consequently, we describe the return on net operating assets (RNOA) that is arguably more informative.

This module’s explanation of financial statement analysis begins at the most aggregate level and works down to three levels of disaggregation. The most aggregate level is return on equity (ROE), which is generally regarded as the summary measure of financial performance. ROE is then disaggregated into key drivers of profitability and asset utilization. The framework of ROE disaggregation is depicted in Exhibit 3.1.

![Exhibit 3.1](eas70119_mod03.qxd)

ROE disaggregation serves to answer several important questions in analyzing financial performance. Examples are:

- What is driving the company’s financial performance?
  - Is it related solely to profitability?
  - What aspects of company profitability are important?
- Is the company effectively managing its balance sheet (investing and financing activities)?
- Is the company relying more on operating or nonoperating activities?
- Do its assets generate sufficient revenues?

These are but a sampling of questions that an analysis of ROE through its disaggregation can help answer.

The first level of disaggregation separates ROE into two basic drivers: return from operating activities and return from nonoperating activities. This identifies drivers by business activities. The second level of analysis examines the drivers of return on operating activities: profitability and asset utilization. A third level of disaggregation explores both of those components of return on operating activities for further insights into the drivers of company performance.

After a complete explanation of ROE disaggregation, we conclude the module with a discussion of credit analysis. A major part of credit analysis involves liquidity and solvency assessments. As part of that discussion, we identify the ratios typically used to determine bond investment ratings, a key determinant

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1An alternate definition for return on assets is: \( \text{ROA} = \frac{\text{Net income} + \text{After-tax interest expense}}{\text{Average total assets}} \). While the numerator in this formulation seeks to focus on operating income, the denominator (total assets) still includes nonoperating (financial) components.
Module 3: Analyzing and Interpreting Financial Statements

of both bond prices and the cost of debt financing for many companies. In that spirit, we also introduce and describe bankruptcy prediction.

■ RETURN ON EQUITY (ROE)

Return on equity (ROE) is the ultimate measure of performance from the shareholders’ perspective. It is computed as follows:

\[
ROE = \frac{\text{Net Income}}{\text{Average Equity}}
\]

Net income is the bottom line from the income statement. Net income includes revenues from all sources, both operating and nonoperating. It also includes expenses from all sources, including cost of goods sold, selling, general, and administrative expenses, and nonoperating (financial) expenses like interest.\(^2\)

ROE is disaggregated into operating and nonoperating components as follows (see Appendix 3B for its derivation):

\[
ROE = RNOA + (FLEV \times \text{Spread})
\]

This is an important disaggregation, and the definitions for these variables along with their typical components are in Exhibit 3.2—this table includes additional variables that are subsequently defined. The above formula emphasizes the two key drivers of ROE: operating (RNOA) and nonoperating (FLEV \times \text{Spread}) activities. Stakeholders prefer ROE to be driven by operating activities.

EXHIBIT 3.2 ■ Key Ratio Definitions

<table>
<thead>
<tr>
<th>Ratio</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROE: return on equity</td>
<td>Net Income/Average Equity</td>
</tr>
<tr>
<td>RNOA: return on net operating assets</td>
<td>NOPAT/Average NOA</td>
</tr>
<tr>
<td>NOPAT: net operating profit after tax</td>
<td>Sales and other operating revenues less operating expenses such as cost of sales, taxes, selling, general, and administrative; it excludes nonoperating revenues and expenses such as those from financial assets and liabilities</td>
</tr>
<tr>
<td>NOA: net operating assets</td>
<td>Current and long-term operating assets less current and long-term operating liabilities; it excludes investments in securities, short- and long-term interest-bearing debt, and capitalized lease obligations</td>
</tr>
<tr>
<td>FLEV: financial leverage</td>
<td>NFO/Average Equity</td>
</tr>
<tr>
<td>NFO: net financial obligations</td>
<td>Financial (nonoperating) obligations less financial (nonoperating) assets</td>
</tr>
<tr>
<td>Spread</td>
<td>RNOA – NFR</td>
</tr>
<tr>
<td>NFR: net financial rate</td>
<td>NFE/Average NFO</td>
</tr>
<tr>
<td>NFE: net financial expense</td>
<td>NOPAT – Net income; it includes interest expense less revenues from nonoperating assets, net of tax</td>
</tr>
</tbody>
</table>

For a recent 34-year period, the median ROE achieved by all publicly traded U.S. companies was 12.2% (from Nissim and Penman, 2001). Most of this ROE is driven by RNOA as illustrated in the following table of median values for those companies and years:

<table>
<thead>
<tr>
<th>ROE Disaggregation*</th>
<th>ROE</th>
<th>RNOA</th>
<th>(FLEV \times \text{Spread})</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st quartile (25th percentile)</td>
<td>6.3%</td>
<td>+</td>
<td>0.05 \times -0.5%</td>
</tr>
<tr>
<td>Median (50th percentile)</td>
<td>10.3%</td>
<td>+</td>
<td>0.40 \times 3.3%</td>
</tr>
<tr>
<td>3rd quartile (75th percentile)</td>
<td>15.6%</td>
<td>+</td>
<td>0.93 \times 10.3%</td>
</tr>
</tbody>
</table>

*Numbers in the table are medians (50th percentile) and quartiles (25th or 75th percentile); thus, the equation does not exactly equal ROE.

\(^2\)Net income does not include dividend payments as they are not a deductible expense in the computation of GAAP income (instead, dividends are considered a distribution of income).
This table shows that companies are, on average, conservatively financed with a greater proportion of equity than net financial obligations (evident from FLEV \( < 1.0 \)). Also, companies earn, on average, a positive spread on borrowed monies (3.3%). This is not always the case, however, as evidenced by the lowest 25% of companies. Most important, RNOA is, on average, approximately 84% of ROE (10.3%/12.2%).

**BUSINESS INSIGHT 3M’s Return on Equity Breakdown**

The following graph shows that 3M’s ROE and RNOA have increased steadily since 1999, with the exception of 2001, which was impacted by costs of its restructuring program.

ROE exceeds RNOA in all years. The difference between ROE and RNOA lines is the return from non-operating activities (FLEV \( \times \) Spread). Since ROE exceeds RNOA for 3M, it shows that 3M is, on average, able to invest borrowed funds with a return exceeding its borrowing rate. The following data underlying this graph shows that 3M’s financial leverage is only slightly higher than the 0.40 median for U.S. companies. Specifically, for 2003, and per the ROE disaggregation, 3M’s ROE of 34.6% equals its RNOA of 24.7% plus its FLEV \( \times \) Spread of 9.9%.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>ROE</td>
<td>34.6%</td>
<td>32.7%</td>
<td>22.7%</td>
<td>27.8%</td>
<td>28.0%</td>
</tr>
<tr>
<td>RNOA</td>
<td>24.7</td>
<td>22.5</td>
<td>16.8</td>
<td>18.4</td>
<td>19.6</td>
</tr>
<tr>
<td>FLEV</td>
<td>45.5</td>
<td>51.9</td>
<td>45.4</td>
<td>42.5</td>
<td>41.5</td>
</tr>
<tr>
<td>Spread</td>
<td>21.8</td>
<td>19.5</td>
<td>14.8</td>
<td>15.8</td>
<td>16.9</td>
</tr>
</tbody>
</table>

**LEVEL 1 ANALYSIS—RNOA AND LEVERAGE**

This section drills down one level in ROE disaggregation analysis to investigate the two main drivers of ROE: the return on net operating assets (RNOA) and the return from nonoperating activities (FLEV \( \times \) Spread) as illustrated in Exhibit 3.3. We first discuss the return on net operating assets, followed by a discussion of the effects of financial leverage, including its advantages and disadvantages.

**EXHIBIT 3.3  Level 1 of ROE Disaggregation**

- **ROE** = \( \frac{\text{Net Income}}{\text{Average Equity}} \)
  = \( \frac{\text{RNOA}}{\text{FLEV} \times \text{Spread}} \)

- **RNOA** = \( \frac{\text{NOPAT}}{\text{Average NOA}} \)
- **FLEV** = \( \frac{\text{Average NFO}}{\text{Average Equity}} \)
- **Spread** = \( \frac{\text{RNOA-NFR}}{\text{RNOA-NFR}} \)
Return on Net Operating Assets (RNOA)

The return on net operating assets (RNOA) is normally the most important driver of ROE. It is computed as follows:

\[
\text{RNOA} = \text{NOPAT/Average NOA}
\]

where
- NOPAT is net operating profit after tax
- NOA is net operating assets

Both NOPAT and NOA are explained in detail below. RNOA reflects the operating side of the business (the other is the nonoperating, or financial, side). To appreciate the importance of RNOA, we must first understand the difference between the operating and nonoperating assets and liabilities (equity is always nonoperating).

Exhibit 3.4 presents a typical balance sheet with the nonoperating (financial) assets and liabilities highlighted. All other assets and liabilities are considered operating.

EXHIBIT 3.4  ■  Distinguishing Operating and Nonoperating Assets and Liabilities

Operating assets and liabilities are those necessary to conduct the company’s business. These include current operating assets such as cash, accounts receivable, inventories, prepaid expenses, and short-term deferred tax assets. It also includes current operating liabilities such as accounts payable, accrued liabilities, and short-term deferred tax liabilities. Net operating working capital (NOWC) equals operating current assets less operating current liabilities.

The current nonoperating assets include short-term investments in marketable securities. The current nonoperating liabilities include short-term interest-bearing notes payable, interest payable, and current maturities of long-term interest-bearing liabilities (and capitalized lease obligations).

Long-term operating assets include property, plant, and equipment (PPE), long-term investments related to strategic acquisitions (equity method investments, goodwill, and acquired intangible assets), deferred tax assets, and capitalized lease assets. Long-term operating liabilities include pensions and other postretirement liabilities and deferred income tax liabilities.

Long-term nonoperating assets include long-term investments in marketable securities and nonstrategic investments, and investments in nonoperating assets (such as discontinued operations prior to sale).\(^3\)

\(^3\)Discontinued operations are, by definition, not part of the continuing operating activities of the company. Although not financial in nature, we classify them as nonoperating as they represent an investment in the process of disposition.
Long-term nonoperating liabilities include bonds and other long-term interest-bearing liabilities, and any noncurrent portion of capitalized leases. Stockholders’ equity includes all of the components of contributed and earned capital, net of treasury stock and other comprehensive income, plus minority interest recognized from business combinations.

The distinction between operating and nonoperating activities is summarized in Exhibit 3.5. Net operating assets (NOA) of the company consist of current and long-term operating assets less current and long-term operating liabilities. Stated differently, net operating assets consist of net operating working capital plus long-term net operating assets.

EXHIBIT 3.5 | Simplified Operating and Nonoperating Balance Sheet

<table>
<thead>
<tr>
<th>Assets</th>
<th>Liabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net Operating Assets (NOA)</td>
<td>Current Operating Assets</td>
</tr>
<tr>
<td>(Assets – Liabilities)</td>
<td>Long-Term Operating Assets</td>
</tr>
<tr>
<td>Net Financial Obligations (NFO)</td>
<td>Financial Assets</td>
</tr>
<tr>
<td>(Liabilities – Assets)</td>
<td>(Nonoperating)</td>
</tr>
<tr>
<td>Equity (NOA-NFO)</td>
<td>Financial Obligations</td>
</tr>
<tr>
<td></td>
<td>(Nonoperating)</td>
</tr>
<tr>
<td></td>
<td>Stockholders’ Equity</td>
</tr>
</tbody>
</table>

Nonoperating assets and liabilities are primarily financial in nature, and typically represent investments in marketable securities and discontinued operations, and borrowings in interest-bearing debt. Net financial obligations (NFO) are the net of financial (nonoperating) obligations less financial (nonoperating) assets. Net financial obligations are positive if net financial obligations exceed net financial assets and negative otherwise.

Since the accounting equation stipulates that Assets = Liabilities + Equity, we can also net this adjusted (reformulated) balance sheet to yield the following identity:

Net Operating Assets (NOA) = Net Financial Obligations (NFO) + Stockholders’ Equity

The RNOA computation and analysis also require that we distinguish between operating and nonoperating profit. Net operating profit after tax (NOPAT), the numerator of RNOA, is the after-tax profit earned from net operating assets. It includes sales less: cost of goods sold (COGS), operating expenses (OE) such as selling, general, and administrative (SG&A) expenses, and taxes on pretax operating profit.\(^4\) Items excluded from NOPAT include interest revenue and expense, dividend revenue, and income or loss from discontinued operations.\(^5\) More generally, NOPAT is computed as follows:

\[
\text{NOPAT} = (\text{Sales} - \text{Operating Expenses}) \times \left[1 - \frac{\text{Tax Expense}}{\text{Pretax Income}}\right]
\]

Sales less operating expense yields pretax operating profits. The expression (Tax Expense/Pretax Income) yields the effective tax rate for the period. Multiplying pretax operating profit by one minus the effective tax rate yields net operating profit after tax, or NOPAT.\(^6\)

The operating versus nonoperating distinction is different from the core (also called permanent and persistent) versus transitory distinction for earnings components that was discussed in Module 2. Exhibit 3.6 lists typical income statement items categorized by operating versus nonoperating and by core versus transitory.\(^7\)

\(^4\)Earnings on equity method investments (covered in Module 6) are operating so long as the equity method investment is classified as a strategic acquisition.

\(^5\)Net income or loss on discontinued operations, and the gain or loss on sale of its net assets, are treated as nonoperating items.

\(^6\)In Module 2, we identified three categories of income statement items that are presented after income from continuing operations (called below the line), net of tax: discontinued operations, extraordinary items, and changes in accounting principles. Discontinued operations are generally viewed as nonoperating. Extraordinary items and changes in accounting principles are often related to operating activities and, if so, are included in NOPAT.

\(^7\)The items listed are meant to give you a general idea of the composition of these categories and are not a complete listing.
Module 3: Analyzing and Interpreting Financial Statements

**EXHIBIT 3.6** Distinguishing Operating, Nonoperating, Core, and Transitory Income

<table>
<thead>
<tr>
<th>Core</th>
<th>Transitory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating</td>
<td>Operating asset write-downs; nonrecurring restructuring accruals; gains and losses on sales of operating assets</td>
</tr>
<tr>
<td>Nonoperating</td>
<td>Debt retirement gains and losses; gains and losses on discontinued operations</td>
</tr>
</tbody>
</table>

**Financial Leverage and Risk**

Management strives to increase ROE, and both RNOA and financial leverage (FLEV) are the drivers of ROE. Thus, one way to increase ROE is to increase RNOA through improved operating performance. The other way to increase ROE is with the successful use of financial leverage.

To illustrate the effect on ROE of increased financial leverage, assume that a company is financed solely with equity. This means that a $1,000 shareholder investment yields $1,000 in assets that earn a RNOA of, say, 10.3%. Alternatively, assume that this company is financed with $1,000 in shareholder equity and $500 in nonowner financing costing 6.1% after tax. In this case the ROE is 12.4%, computed as $1,000(10.3%) + $500(6.1%) = 16.4%. ROE is 10.3% without leverage, but 12.4% with leverage, a difference of 2.1%. The source of this difference is the $500 of debt-financed assets with a spread of 4.2% (10.3% − 6.1%); yielding a dollar increase of $21 or 2.1% of our $1,000 equity investment. This indicates the beneficial effect on ROE from financial leverage when a positive spread is achieved.

If increases in financial leverage increase ROE, why are all companies not 100% debt financed? The answer is because debt is risky. Debt is a contractual obligation that must be met regardless of the company’s current financial status. If not met, creditors can ultimately force payment, which can lead to company bankruptcy and liquidation, much to the detriment of shareholders who are residual claimants and can potentially lose their entire investment.

**RESEARCH INSIGHT** Ratio Behavior over Time

How do ROE, RNOA, and NFR ratios behave over time? Following is a graph of these ratios over a recent 34-year period (from graph B, p.134, of Nissim and Penman, 2001, *Review of Accounting Studies* 6 (1), pp. 109–154, with permission of Springer Science and Business Media). There is considerable variability in these ratios over time. Also, the proportion of RNOA to ROE is greater for some periods of time than for others. Yet, in all periods, RNOA exceeds the net financial rate, NFR. This is evidence of a positive effect, on average, for ROE from financial leverage.
Higher financial leverage also results in a higher cost of debt for the company (this is explained later in the module). Several credit-rating companies such as **Standard & Poor’s** and **Moody’s Investors Service** rate publicly traded debt. Those ratings partly determine the debt’s interest rate—with lower quality ratings yielding higher interest rates and vice versa. So, all else equal, higher financial leverage lowers a company’s debt rating and increases the interest rate it must pay.

Debtholders (creditors) also typically require a company to execute a loan agreement that places varying restrictions on its operating activities. These restrictions, called **covenants**, help safeguard debtholders in the face of increased risk (recall, debtholders do not have a voice on the board of directors). These debt covenants also impose a cost on the company via restrictions on its activities, and these restrictions become more stringent with increased reliance on nonowner financing.

**Financial Leverage and Income Variability**

Financial leverage can also affect income variability. To illustrate, we must first define variable and fixed costs. **Variable costs** are those that change in proportion to changes in sales volume. **Fixed costs** are those that do not change with changes in sales volume (over a reasonable range).

Debt with a fixed rate of interest introduces fixed costs into the cost structure. The effect of fixed interest costs on income variability is evidenced in Exhibit 3.7.

<table>
<thead>
<tr>
<th>Case</th>
<th>Case 2</th>
<th>Case 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales</td>
<td>$10,000</td>
<td>$8,000</td>
</tr>
<tr>
<td>Variable costs (40%)</td>
<td>4,000</td>
<td>3,200</td>
</tr>
<tr>
<td>Fixed costs</td>
<td>2,000</td>
<td>2,000</td>
</tr>
<tr>
<td>Net income</td>
<td>$ 4,000</td>
<td>$2,800</td>
</tr>
<tr>
<td>Percentage change in sales</td>
<td>—</td>
<td>(20)%</td>
</tr>
<tr>
<td>Percentage change in income</td>
<td>—</td>
<td>(30)%</td>
</tr>
</tbody>
</table>

A given percentage change in revenues generates a greater percentage change in income. Exhibit 3.7 shows that a 20% change in revenues (cases 2 and 3) generates a 30% income change. Leverage is a **magnifier**—positive when revenues increase, and negative when revenues decrease.

The effect of financial leverage (fixed costs) on ROE is shown in Exhibit 3.8. For a given increase or decrease in revenues, the change in ROE is greater for a higher leverage (fixed cost) company.

**EXHIBIT 3.8**  ■ Effect of Leverage on ROE Variability

![Effect of Leverage on ROE Variability](image)

Thus, although a higher level of ROE is desirable, there is a difference between high ROE generated by operating activities (RNOA) and high ROE generated from high levels of financial leverage (FLEV). As illustrated above, use of financial leverage can benefit shareholders. Financial leverage, however, is a double-edged sword. Its downside is an increased level of risk in the form of higher probability for
financial distress and bankruptcy if debt payments cannot be made and with greater variability in net income and ROE.

**MID-MODULE REVIEW 1**

Caterpillar, Inc., is a manufacturer of construction equipment. It consists of two segments: one manufactures equipment and the other provides financing (loans and leases) to customers. The finance company is like other financial institutions with high financial leverage and a small spread on loan rates over the cost of debt it incurs to finance those loans. Following is the comparative balance sheets and income statements for Caterpillar, Inc.

<table>
<thead>
<tr>
<th>CATERPILLAR, INC. Balance Sheets</th>
<th>2003</th>
<th>2002</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Assets</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current assets</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cash and short-term investments</td>
<td>$342</td>
<td>$309</td>
</tr>
<tr>
<td>Receivables—trade and other</td>
<td>3,666</td>
<td>2,838</td>
</tr>
<tr>
<td>Receivables—finance</td>
<td>7,605</td>
<td>6,748</td>
</tr>
<tr>
<td>Deferred and refundable income taxes</td>
<td>707</td>
<td>781</td>
</tr>
<tr>
<td>Prepaid expenses</td>
<td>1,424</td>
<td>1,224</td>
</tr>
<tr>
<td>Inventories</td>
<td>3,047</td>
<td>2,763</td>
</tr>
<tr>
<td>Total current assets</td>
<td>16,791</td>
<td>14,663</td>
</tr>
<tr>
<td>Property, plant and equipment—net</td>
<td>7,290</td>
<td>7,046</td>
</tr>
<tr>
<td>Long-term receivables—trade and other</td>
<td>82</td>
<td>66</td>
</tr>
<tr>
<td>Long-term receivables—finance</td>
<td>7,822</td>
<td>6,714</td>
</tr>
<tr>
<td>Investments in unconsolidated affiliated companies</td>
<td>800</td>
<td>747</td>
</tr>
<tr>
<td>Deferred income taxes</td>
<td>616</td>
<td>711</td>
</tr>
<tr>
<td>Intangible assets</td>
<td>239</td>
<td>281</td>
</tr>
<tr>
<td>Goodwill</td>
<td>1,398</td>
<td>1,402</td>
</tr>
<tr>
<td>Other assets</td>
<td>1,427</td>
<td>1,117</td>
</tr>
<tr>
<td>Total assets</td>
<td>$36,465</td>
<td>$32,747</td>
</tr>
<tr>
<td><strong>Liabilities</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current liabilities</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Short-term borrowings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Machinery and engines</td>
<td>$72</td>
<td>$64</td>
</tr>
<tr>
<td>Financial products</td>
<td>2,685</td>
<td>2,111</td>
</tr>
<tr>
<td>Accounts payable</td>
<td>3,100</td>
<td>2,269</td>
</tr>
<tr>
<td>Accrued expenses</td>
<td>1,638</td>
<td>1,620</td>
</tr>
<tr>
<td>Accrued wages, salaries, and employee benefits</td>
<td>1,802</td>
<td>1,779</td>
</tr>
<tr>
<td>Dividends payable</td>
<td>127</td>
<td>120</td>
</tr>
<tr>
<td>Deferred and current income taxes payable</td>
<td>216</td>
<td>70</td>
</tr>
<tr>
<td>Long-term debt due within one year</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Machinery and engines</td>
<td>32</td>
<td>258</td>
</tr>
<tr>
<td>Financial products</td>
<td>2,949</td>
<td>3,654</td>
</tr>
<tr>
<td>Total current liabilities</td>
<td>12,621</td>
<td>11,945</td>
</tr>
<tr>
<td><strong>Total liabilities</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Long-term debt due after one year</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Machinery and engines</td>
<td>3,367</td>
<td>3,403</td>
</tr>
<tr>
<td>Financial products</td>
<td>10,711</td>
<td>8,193</td>
</tr>
<tr>
<td>Liability for postemployment benefits</td>
<td>3,172</td>
<td>3,333</td>
</tr>
<tr>
<td>Deferred income taxes and other liabilities</td>
<td>516</td>
<td>401</td>
</tr>
<tr>
<td><strong>Total liabilities</strong></td>
<td>30,387</td>
<td>27,275</td>
</tr>
<tr>
<td><strong>Stockholders’ equity</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Common stock of $1.00 par value; Authorized shares: 900,000,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Issued shares (2003 and 2002—407,447,312) at paid-in amount</td>
<td>1,059</td>
<td>1,034</td>
</tr>
<tr>
<td>Treasury stock (2003—63,685,272 shares; 2002—63,192,245 shares) at cost</td>
<td>(2,914)</td>
<td>(2,669)</td>
</tr>
<tr>
<td>Profit employed in the business</td>
<td>8,450</td>
<td>7,849</td>
</tr>
<tr>
<td>Accumulated other comprehensive income</td>
<td>(517)</td>
<td>(742)</td>
</tr>
<tr>
<td><strong>Total stockholders’ equity</strong></td>
<td>6,078</td>
<td>5,472</td>
</tr>
<tr>
<td><strong>Total liabilities and stockholders’ equity</strong></td>
<td>$36,465</td>
<td>$32,747</td>
</tr>
</tbody>
</table>
Module 3: Analyzing and Interpreting Financial Statements

CATERPILLAR, INC.
Income Statements

For Year Ended December 31 ($ millions) 2003 2002

Sales and revenues
Sales of machinery and engines .......................................................... $21,048 $18,648
Revenues of financial products .......................................................... 1,715 1,504
Total sales and revenues ................................................................. 22,763 20,152

Operating costs
Costs of goods sold ............................................................................ 16,945 15,146
Selling, general and administrative expenses ..................................... 2,470 2,094
Research and development expenses .................................................. 669 656
Interest expense of financial products ................................................. 470 521
Other operating expenses .................................................................. 521 411
Total operating costs ......................................................................... 21,075 18,828

Operating profit .................................................................................. 1,688 1,324
Interest expense excluding financial products ..................................... 246 279
Other income (expense) ..................................................................... 35 69
Consolidated profit before taxes .......................................................... 1,477 1,114
 Provision for income taxes ................................................................. 398 312
Profit of consolidated companies ....................................................... 1,079 802
Equity in profit (loss) of unconsolidated affiliated companies ............. 20 (4)
Profit .................................................................................................. $ 1,099 $ 798

Required
Using Caterpillar’s (CAT) financial information, compute the following for 2003 (refer to Exhibits 3.2 through 3.5 for guidance).

1. Balance sheet amounts
   a. Net operating working capital (NOWC)
   b. Net operating long-term assets (NOLTA)
   c. Net operating assets (NOA) (Note: a + b = c)
   d. Net financial obligations (NFO)
   e. Shareholders’ equity
   f. Confirm that c = d + e

2. Income statement amounts
   a. Net operating profit after tax (NOPAT)
   b. Net income
   c. Net financial expense
   d. Confirm that c = a − b

3. Financial ratios and measures
   a. Return on equity (ROE)
   b. Return on net operating assets (RNOA)
   c. Financial leverage (FLEV)
   d. Net financial rate (NFR)
   e. Spread
   f. Confirm: ROE = RNOA + (FLEV × Spread)

4. What insights do you draw about Caterpillar’s financial performance from its Level I analysis of ROE?

Solution

1. a. Net operating working capital (NOWC) ........................................ $ 9,908
   \[
   \text{NOWC} = \text{Current Operating Assets} - \text{Current Operating Liabilities} = ($16,791 - 0) - ($12,621 - [2,685 + 72] - 2,981) 
   \]

   b. Net operating long-term assets (NOLTA) ..................................... 15,986
   \[
   \text{NOLTA} = \text{Long-Term Operating Assets} - \text{Long-Term Operating Liabilities} = ($36,465 - 16,791) - 0 - ($516 + 3,172) 
   \]

   c. Net operating assets (NOA) ..................................................... 25,894
   \[
   \text{NOA} = \text{Operating Assets} - \text{Operating Liabilities} = ($36,465 - 0) - ($30,387 - 2,757 - 2,981 - 14,078) 
   \]
Module 3: Analyzing and Interpreting Financial Statements

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Module 3: Analyzing and Interpreting Financial Statements

LEVEL 2 ANALYSIS—MARGIN AND TURNOVER

This section focuses on Level 2 analysis, which disaggregates RNOA into net operating profit margin (NOPM) and net operating asset turnover (NOAT). The purpose here is to identify the key drivers of RNOA. Nearly all goals of financial analysis are future oriented. Examples are predicting future operating income, pricing companies' securities, forming opinions about companies' debt-paying abilities, evaluating alternate strategies, and making managerial decisions. Understanding the drivers of financial performance (RNOA) is key to effectively predicting future performance. To highlight the development of our analytical framework, Exhibit 3.9 presents the Level 1 disaggregation of ROE into operating (RNOA) and nonoperating components (FLEV × Spread) and the Level 2 disaggregation of RNOA into its components: net operating profit margin (NOPM) and net operating asset turnover (NOAT). The latter is the focus of this section.

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d. Net financial obligations (NFO) ...........................................
   \[ \text{NFO} = \text{Nonoperating Liabilities} \ - \ \text{Nonoperating Assets} \]
   \[ = ($2,757 + $2,981 + $14,078) \ - \ ($0) \]

e. Stockholders' equity (given) ...............................................
   \[ c = d + e \]
   \[ 25,894 = 19,816 + 6,078 \ (\text{confirmed}) \]

2. a. Net operating profit after tax (NOPAT) ................................. 1,253
   \[ \text{NOPAT} = \left[ \text{Net Operating Profit} \times (1 \ - \ \text{Effective Tax Rate}) \right] + \text{Other Income, net of tax} \]
   Note: CAT's income statement references "equity in profit (loss) of unconsolidated affiliated companies." We cover the concept of equity income of unconsolidated affiliates in Module 6.

3. a. Return on equity (ROE) .................................................. 19.0%
   \[ \text{ROE} = \frac{\text{Net Income}}{\text{Average Stockholders' Equity}} \]
   \[ = \frac{1,099}{($6,078 + $5,472)/2} \]

b. Return on net operating assets (RNOA) ................................. 5.1%
   \[ \text{RNOA} = \frac{\text{NOPAT}}{\text{Average NOA}} \]
   \[ = \frac{1,253}{($25,894 + $23,155)/2} \]

c. Financial leverage (FLEV) ............................................... 324.7%
   \[ \text{FLEV} = \frac{\text{Average NFO}}{\text{Average Stockholders' Equity}} \]
   \[ = \frac{($19,816 + $17,683)/2}{($6,078 + $5,472)/2} \]

d. Net financial rate (NFR) .................................................. 0.8%
   \[ \text{NFR} = \frac{\text{NFE}}{\text{Average NFO}} \]
   \[ = \frac{154}{($19,816 + $17,683)/2} \]

e. Spread ................................................................. 4.3%
   \[ \text{Spread} = \frac{\text{RNOA} \ - \ \text{NFR}}{} \]
   \[ = 5.1 \% - 0.8\% \]

f. 19.0% = 5.1% + (3.247 \times 4.3%) \]

4. Much of CAT’s ROE of 19% is driven by financial leverage, as RNOA is only 5.1%. Remember, CAT’s financial statements include its manufacturing and financial subsidiaries. The financial subsidiary, like many captive finance subsidiaries, is quite large and highly financially leveraged. As a result, the consolidated (combined) balance sheet reflects this leverage. Leverage in a financial subsidiary is usually not as problematic as if it were solely in the manufacturing company; this is because the financial subsidiary’s cash flows are unlikely cyclical. As long as its cash flows are relatively stable, it can handle a higher debt load. The business model for this financial subsidiary, then, is low margins and high financial leverage to yield the target ROE. This is the business model for a typical financial institution.
Disaggregation of RNOA

Level 2 analysis focuses on the disaggregation of RNOA into its two basic components, profit margin and asset turnover, as follows:

\[
\text{RNOA} = \frac{\text{NOPAT}}{\text{Average Net Operating Assets}} = \frac{\text{NOPM}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Average Net Operating Assets}}
\]

The ratio of NOPAT (net operating profit after tax) to sales is the net operating profit margin (NOPM). It reflects the percentage of each sales dollar that the company is realizing in after-tax operating profit. The ratio of sales to net operating assets is the net operating asset turnover (NOAT). Turnover reflects the productivity of assets. Namely, how much revenue does the firm realize from a dollar of operating asset investment.

Management and its stakeholders prefer that both margin and turnover be higher rather than lower as both increase RNOA and, thus, ROE. The next section describes the trade-off between margin and turnover, and how that translates into company performance.

Trade-Off between Margin and Turnover

An infinite number of combinations of net operating profit margin and net operating asset turnover will yield a given RNOA. As depicted in Exhibit 3.10, industries tend to reach RNOA equilibria, which are determined by fundamental business characteristics (data points represent industry medians from over 55,000 observations for the 15 years prior to 2005). That is, some industries, like communication and pharmaceuticals, are capital intensive with relatively low turnover. Accordingly, for such industries to achieve a required RNOA, they must obtain a higher profit margin. Service companies, such as retailers and restaurants, in contrast, carry fewer assets and can operate on lower operating profit margins to achieve a similar RNOA because their asset turnover is far greater.

One implication of Exhibit 3.10 is that we must be careful in evaluating performances of companies in different industries. A higher profit margin in the communication industry than that in the apparel industry is not necessarily the result of better management. Instead, the communication industry requires a higher profit margin to offset its lower asset turnover (resulting from the capital intensity of its industry) to achieve an equivalent return on net operating assets.

The margin and turnover trade-off is obvious when comparing the communication and apparel industries. However, the analysis of conglomerates that are mixtures of several industries is more challenging. Their margins and turnover rates are a weighted average of the margins and turnover rates for the various industries that constitute the company. For example, like Caterpillar, General Motors Corporation (GM) is a blend of a manufacturing company and a financial subsidiary (GMAC). Each of these industries has its own margin and turnover equilibrium, and the margin and turnover for GM on a consolidated basis is a weighted average of the two.
Net Operating Profit Margin (NOPM)

The analysis of profit margin relates to the income statement. Profit margin can be used to compare one income statement number with another, where sales is the usual denominator. It is commonly used to compare the performance of one company over time and/or its performance vis-à-vis its competitors.

The net operating profit (or NOPAT) margin is a useful summary measure of operating performance as it encompasses both the gross profit on sales and operating expenses.\(^8\) It is computed as follows:

\[
\text{Net Operating Profit Margin (NOPM)} = \frac{\text{NOPAT}}{\text{Sales}}
\]

The NOPM is one of the two drivers of RNOA. It is a summary measure of company profitability.

**BUSINESS INSIGHT**

The 3M Margin

The following chart shows that 3M’s net operating profit margin has increased from 11.6% of sales in 1999 to 13.5% in 2003. The 2001 decline was due to 3M’s $568 million pretax restructuring costs, consisting mainly of expected severance costs as it downsized its employee base.

\(^8\) Another common measure of performance is net profit margin (net income/sales), sometimes called return on sales. This measure uses net income, which encompasses both operating and financial components. Our focus on net operating profit margin is to distinguish between operating and nonoperating (financial) components of net profit margin.
Net Operating Asset Turnover (NOAT)

Asset turnover reflects the productivity of company assets. That is, it reflects the amount of capital required to generate a dollar of sales volume. The general form of an asset turnover ratio is:

\[
\text{Asset Turnover} = \frac{\text{Sales}}{\text{Average Assets}}
\]

A turnover ratio uses measures from both the income statement and balance sheet. As depicted in Exhibit 3.10, capital-intensive companies have lower turnover rates than service companies as the amount of assets required to generate a dollar of sales is less for services.

Our interest in asset turnover arises from the following observation: higher turnover reflects greater sales inflow for a given level of assets. Although turnover does not directly impact profitability, it does so indirectly as asset holding costs (such as interest, insurance, warehousing, and logistics) are reduced.

One of the most important measures of turnover is the net operating asset turnover (NOAT), which is defined as:

\[
\text{Net Operating Asset Turnover (NOAT)} = \frac{\text{Sales}}{\text{Average Net Operating Assets}}
\]

For 3M, its 2003 net operating asset turnover is 1.81. Its turnover ratio of 1.81 implies that 3M generates $1.81 in sales from each dollar invested in net operating assets. Another way of interpreting the 1.81 turnover is that for each additional sales dollar, 3M must invest $0.55 in net operating assets (computed as $1/1.81). Thus, each additional sales dollar must generate sufficient operating profit to offset the added investment cost.

3M’s net operating assets have increased over the past three years, mainly from acquisitions of other companies. Specifically, its average net operating working capital has not increased to the extent that sales have increased, and its net property, plant, and equipment (PPE) assets have not increased during this period, as capital expenditures have equaled depreciation. Instead, goodwill and other intangible assets account for most of the growth in its net operating assets.

It is crucial that companies monitor their asset utilization. They must also take action if asset growth is excessive. For example, they can sell excess capacity of underutilized assets or outsource production of some products. Later in this module we explore means to monitor, analyze, and interpret the effective use of net operating assets.

### BUSINESS INSIGHT

**Turnover at 3M**

The following chart shows 3M’s net operating asset turnover, which is reasonably steady during the past five years. Its largest value is 1.83 times in 2000 and its lowest is 1.75 in 2001 (the restructuring year). 3M’s net operating asset turnover is below the 1.97 median for all publicly traded firms.

![3M NOAT Chart](chart.png)

### MID-MODULE REVIEW 2

Refer to the Mid-Module Review 1 for the financial statements of Caterpillar, Inc.

**Required**

Using Caterpillar’s financial information, compute the following for 2003 (refer to Exhibit 3.9 for guidance).

1. Net operating profit margin and net operating asset turnover
   a. Net operating profit margin (NOPM)
b. Net operating asset turnover (NOAT)
   c. Confirm: RNOA = \( \frac{a}{b} \)

2. What insights do you draw about Caterpillar’s financial performance from its Level 2 analysis of ROE?

Solution
1. a. Net operating profit margin (NOPAT/Sales) .......................................................... \( 5.5\% \)
   b. Net operating asset turnover (NOAT) ................................................................. \( 0.93 \) times
      \[
      \text{NOAT} = \frac{22,763}{\left( \frac{\$25,894 + \$23,155}{2} \right)}
      \]
   c. RNOA: \( 5.1\% = 5.5\% \times 0.93 \) (confirms Mid-Module Review 1, part 3b) ........... \( 5.1\% \)

2. CAT’s RNOA is relatively low as it is within the bottom quartile of median RNOAs for publicly traded companies (RNOA of under 6%)—see table in the earlier part of this module. Also, CAT is in a capital intensive industry. The median turnover of net operating assets for all companies is 1.94, and CAT is well below that level (0.93). Although its NOPM approximates the median for all companies, its low NOAT hinders its ability to achieve acceptable returns on net operating assets.

MANAGERIAL DECISION

You are analyzing the performance of your startup company. Your analysis of RNOA reveals the following (industry benchmarks in parenthesis): RNOA is 16% (10%), NOPM is 18% (17%), and NOAT is 0.89 (0.59). What interpretations do you draw that are useful for managing your company? [Answer, p. 3-30]

LEVEL 3 ANALYSIS—DISAGGREGATION OF MARGIN AND TURNOVER

This section focuses on Level 3 analysis, which highlights the disaggregation of profit margin and asset turnover to better understand the drivers of RNOA. Again, understanding the drivers of financial performance (RNOA) is key to predicting future company performance. To help frame our presentation, Exhibit 3.11 shows the full analytical framework for disaggregation of ROE into Level 1 components, the return from operating activities (RNOA) and the return from nonoperating activities (FLEV × Spread), the Level 2 disaggregation of RNOA into profit margin (NOPM) and asset turnover (NOAT), and the Level 3 analysis of the drivers of operating profit margin and asset turnover.

EXHIBIT 3.11 Framework for ROE Disaggregation
**Gross Profit Margin (GPM)**

Gross profit is net sales less cost of goods sold. It represents the markup of selling price over costs that the company has incurred in manufacturing or purchasing the goods sold. Analysis of gross profit dollars is not usually meaningful as it results from both the unit markup and the number of units sold, either or both can change over time or differ across companies. Instead, we focus on gross profit margin, which is defined as follows:

\[
\text{Gross Profit Margin (GPM)} = \frac{\text{Gross Profit}}{\text{Sales}}
\]

Conducting gross profit analysis in ratio form serves two objectives. First, it mitigates any problem arising when comparing different sized companies. Second, it allows us to focus on average markup per unit sold, which abstracts from the volume of units sold in our analysis.

Analysis of gross profit margin provides insight into a company’s average markup on its product cost through selling prices. A higher gross profit margin is preferred to a lower one. A higher gross profit margin also means that a company has more flexibility in product pricing. Such companies are historically more profitable.

Two main factors determine gross profit margin:

1. Competition. When competition intensifies, more substitutes become available, which limits a company’s ability to raise prices and pass on cost increases to customers.
2. Product mix. When lower-priced, higher-volume products increase in proportion to higher-priced, lower-volume products, gross profit margin declines.

Absent product mix changes, a decline in gross profit margin is generally viewed negatively as it suggests that a company’s products have lost some competitive advantage. Reasons can include failures in product quality, style, or technology.

3M’s gross profit margin has improved in recent years. However, in 2001, its GPM declined by 1.9 percentage points, which is substantial. In its 10-K for that year, 3M reports that special items, principally related to its restructuring program, accounted for 1.7 of the 1.9 points of that decline.

3M credits the reductions in its cost of goods sold to its manufacturing efficiencies and purchasing initiatives. Following is an excerpt from its 2003 10-K that provides part of 3M’s explanation:

Cost of sales in 2003 benefited from ... projects aimed at improving manufacturing throughput, yield and productivity. 3M’s global sourcing initiative has helped mitigate the impact of raw material price increases. Raw material costs were essentially flat versus 2002. In 2002, gross margins were positively impacted by improved plant efficiencies and lower raw material costs, again helped by 3M’s global sourcing initiative. Special items, as a percent of sales, negatively impacted cost of sales by 0.7 percentage points in 2002 and 1.7 percentage points in 2001.

**Operating Expense Margin (OEM)**

Operating expense ratios (percents) reflect the proportion of sales consumed by each of the major operating expense categories. These ratios are generally computed as follows:

\[
\text{Operating Expense Margin (OEM)} = \frac{\text{Operating Expenses}}{\text{Sales}}
\]

The focus is on any changes over time in the proportion of company sales invested in operating expenses. We can examine any number of separate components of operating expenses divided by sales. These outlays must produce a satisfactory return and create long-term shareholder value. The financial impacts from some expenditures, such as those in advertising and research and development, are self-evident. Also, companies can achieve short-term gains by reducing expenditures in these areas (advertising and R&D outlays are expensed under GAAP). However, persistent underfunding of advertising and R&D can adversely impact a company’s competitive position and future performance.
This is an important point. Namely, it is not necessarily better to have a lower operating expense margin. Expenses represent investments, although they are not recognized on the balance sheet as assets. As with any investment, we must expect an acceptable return. This means the objective is not necessarily to reduce operating expenses. Instead, it is to optimize them—make sure that they are producing an acceptable return, the aim being to increase RNOA.

3M has two large operating expenses: R&D costs and selling, general, and administrative (SG&A) expenses. 3M’s percent of sales invested in R&D has remained constant for the past five years. Its business depends on R&D to maintain its competitive advantage. Cutbacks in R&D for short-run profits are probably at the cost of long-run profits.

3M’s SG&A expense as a percentage of sales has decreased from 23.6% to 22.2% in the past five years. This 1.4 percentage point decrease is substantial for a mature company of this size and reflects 3M’s commitment to cost control.

**Accounts Receivable Turnover (ART)**

Disaggregation of total asset turnover gives further insights into the drivers of RNOA. The accounts receivable turnover (ART) is one of those disaggregates. It provides insights into the sales impact of accounts receivable. That is, receivables are an asset, just like inventories and equipment, and the accounts receivable turnover reflects the investment in receivables required to generate a dollar of sales. This turnover ratio is defined as follows:

\[
\text{Accounts Receivable Turnover (ART)} = \frac{\text{Sales}}{\text{Average Accounts Receivable}}
\]

The higher this turnover ratio, the lower the required investment. Generally, companies want a higher receivables turnover, as this reflects greater sales for a given level of accounts receivable.

3M’s accounts receivable turnover ratio increased from 5.79 times in 1999 to 6.96 times in 2003. This is a marked increase that should enhance its profitability and cash flow.

Although companies desire to minimize their investment in accounts receivable, the extension of credit is one of the marketing tools available to a company. Each tool has its cost. While the cost of advertising is easy to see, the cost of credit extension is less evident.

Receivables are an asset that must be financed like any other asset. In addition, receivables entail collection risk and require additional overhead in the form of credit and collection departments. On the other hand, reducing collection overhead costs with an overly restrictive credit policy hurts sales. Receivables must, therefore, be effectively managed.

An intuitive formulation of a measure related to accounts receivable turnover is the average collection period, which follows:

\[
\text{Average Collection Period} = \frac{\text{Accounts Receivable}}{\text{Average Daily Sales}}
\]

This metric reflects how long accounts receivable are outstanding, on average.

For 3M, the average collection period has been reduced from 63 days in 1999 to 52.5 days in 2003. More timely collection of receivables reduces the probability of noncollection. Also, the reduction in receivables increases cash flow. For these reasons, 3M’s more timely collection of receivables over the past five years is a positive development.

To assess whether an average collection period of 52.5 days is good or bad, we can compare it to the company’s credit policies. For example, if invoice terms are net 60 days, experience tells us to expect
the average collection period to be about 30 days. Credit terms vary by industry, but are usually 90 days or less. Accordingly, average collection periods longer than 60 days are unusual and, thus, warrant investigation.9

**Inventory Turnover (INVT)**

The inventory turnover ratio provides insight into the inventory investment required to support the current sales volume. It is computed as follows:

\[
\text{Inventory Turnover (INVT)} = \frac{\text{Cost of Goods Sold}}{\text{Average Inventory}}
\]

This ratio uses cost of goods sold (COGS) as a measure of sales volume because the denominator, inventory, is reported at cost, not retail. Accordingly, both the numerator and denominator are measured at cost.

The inventory turnover for 3M increased from 3.82 times per year in 1999 to 4.96 times per year in 2003. This is a substantial improvement in inventory turns. In its 2003 10-K, 3M attributes much of this success to “projects aimed at improving manufacturing throughput, yield, and productivity.” In addition, 3M cites its “global sourcing initiative,” which has helped to control raw materials costs, a main component of its inventory.

When inventory turnover declines, concerns arise about uncompetitive products. (Inventory turnover is also determined by changes in product mix.) Further, such declines add costs. Namely, inventory requires warehouse space and logistics, personnel to monitor and manage them, financing costs, and insurance coverage. Also, the longer inventory sits, the greater is the likelihood of its being damaged or stolen, going out of style, or becoming technologically obsolete. Companies want enough inventory to meet customer demand without stock-outs, and no more.

Analysis of inventory is aided by the following complementary measure that reflects the number of days of sales in inventory:

\[
\text{Average Inventory Days Outstanding} = \frac{\text{Inventory}}{\text{Average Daily Cost of Goods Sold}}
\]

This result gives us some indication of the length of time that inventories sit prior to sale.

For 3M, and commensurate with its increased inventory turnover shown above, we see a reduction in its average inventory days outstanding from 95.4 days in 1999 to 73.7 days in 2003. Although 73 days can seem like a long time for inventories to remain unsold, remember that this includes the time from the purchase of the raw materials, through the manufacturing process, to the time the finished goods are sold.

We want the company inventory cycle to be as short as possible. One way in which companies can reduce inventory cycle is to minimize their raw materials through good inventory management methods such as just-in-time deliveries—which means that inventory sits with suppliers. Similarly, companies can achieve reductions in work-in-progress inventory by efficient production processes that eliminate bottlenecks. Finally, companies can minimize finished goods inventory by producing to orders, not estimated demand, if possible. These management tools increase inventory turnover and reduce the inventory days outstanding.

**Long-Term Operating Asset Turnover (LTOAT)**

Long-term operating asset turnover reflects capital intensity relative to sales and is defined as:

\[
\text{Long-Term Operating Asset Turnover (LTOAT)} = \frac{\text{Sales}}{\text{Average Long-Term Operating Assets}}
\]

Capital intensive industries, like manufacturing companies, require large investments in long-term operating assets. Accordingly, such companies have lower long-term operating asset turnovers than do less capital-intensive companies, like service businesses.

\[\text{Companies with captive finance subsidiaries, and those that offer leasing of their manufactured products, will report longer average collection periods that arise from the length of the financing, not necessarily as a result of uncollectible accounts.}\]
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Higher is better for long-term operating asset turnover. Companies desire to minimize the investment in long-term operating assets required to generate a dollar of sales.

Long-term operating asset turnover for 3M in 2003 is 2.8 times, compared with 3.1 times in 1999. During the intervening five years, 3M grew in asset size, but not in terms of long-term operating asset purchases, which have remained fairly constant (capital expenditures approximating depreciation). Instead, 3M’s increase in long-term operating assets are in the form of goodwill and other intangible assets acquired from acquisitions of other companies. The LTOAT ratio does not distinguish between long-term operating assets purchased individually or as part of a larger corporate acquisition.

Accounts Payable Turnover (APT)

Net operating working capital, defined as current operating assets less current operating liabilities, is financed in large part by accounts payable (also called trade credit or trade payables). Accounts payable represent amounts that one company owes another arising from the purchase of goods. Such payables usually represent interest-free financing and are, therefore, less expensive than using available funds or borrowed money to finance purchases or production. Accordingly, companies use trade credit whenever possible. This is called leaning on the trade.

The accounts payable turnover reflects on management’s success in using trade credit to finance purchases of goods. It is computed as:

\[
\text{Accounts Payable Turnover (APT)} = \frac{\text{Cost of Goods Sold}}{\text{Average Accounts Payable}}
\]

Payables are reported at cost, not retail prices. Thus, for consistency with the denominator, cost of goods sold (not sales) is used in the numerator. Management desires to use trade credit to the greatest extent possible for financing. This means that management desires a lower accounts payable turnover.

For 3M, its accounts payable turnover rate has declined from 10.4 times per year in 2001 to 9.1 times per year in 2003. This decline in accounts payable turnover indicates that these obligations are remaining unpaid for a longer period of time. Again, this is generally interpreted as positive, which reflects management’s effective use of low-cost financing.

A metric analogous to accounts payable turnover is that of average payable days outstanding, which is defined as follows:

\[
\text{Average Payable Days Outstanding} = \frac{\text{Accounts Payable}}{\text{Average Daily Cost of Goods Sold}}
\]

Management hopes to extend the payable days outstanding number to as long as possible provided they do not harm their supply channel relationships.

For 3M, its accounts payable remain unpaid for 40 days in 2003, up from 35 days three years ago. 3M is, therefore, leaning on the trade to a greater extent than it has in the recent past. The increase in payable days outstanding increases cash flow because it reflects greater use of a non-interest-bearing source of funding. So, all else equal, cash flow and profits increase.

Payment policies must be managed with care as increasing payables correspond with increasing
receivables on suppliers’ balance sheets, thus increasing suppliers’ costs. As a result, if suppliers’ bargaining power is greater than the buyers, then suppliers attempt to recoup those costs with higher selling prices. In the extreme, suppliers can refuse to sell to such buyers. Even when buyers possess bargaining leverage, they do not want to exact too high of a cost from suppliers. This is because buyers need a healthy supplier network for a consistent supply source at an acceptable quality level.

**Net Operating Working Capital Turnover (NOWCT)**

Net operating working capital is the investment in short-term net operating assets. It is one of the two general categories of net operating assets (the other being net long-term operating assets). Management’s effectiveness in using operating working capital turnover is reflected in the following metric:

\[
\text{Net Operating Working Capital Turnover (NOWCT)} = \frac{\text{Net Sales}}{\text{Net Operating Working Capital}}
\]

A lower operating working capital turnover reflects a greater investment in working capital for each dollar of sales. Working capital turns more quickly when receivables and inventories turn more quickly, and it also turns more quickly when companies lean on the trade (when payables turn more slowly).

3M has been successful in increasing its net operating working capital turnover from 4.7 times a year in 1999 to 5.5 times a year in 2003. This is mainly due to increasing turnover for receivables and inventories, and a decreasing turnover for payables.

RNOA (and ROE) disaggregation gives us insight into the drivers of company success. Knowing the drivers of operating performance is crucial in forecasting future performance, which is the ultimate object of most analyses. Still, we must remember that to fully understand the drivers of operating performance, we must analyze the company’s business, not just its financial reports. That analysis entails an understanding of the company’s markets, its products, its execution, and a number of other strategic factors.

### MID-MODULE REVIEW 3

Refer to the Mid-Module Review 1 for the financial statements of Caterpillar, Inc.

**Required**

Using Caterpillar’s financial information, compute the following for 2003.

1. **Profit margins**
   a. Gross profit margin on machinery and engines (GPM)
   b. Selling, general, and administrative costs as a percentage of total sales and revenues (SGAM for short)

2. **Asset turnovers**
   a. Accounts receivable turnover (ART) for machinery and engines
   b. Average collection period (Accounts Receivable/Average Daily Sales)
   c. Inventory turnover (INVT) on machinery and engines
   d. Average machinery and engine inventory days outstanding (Inventories/Average Daily COGS for Machinery and Engines)
   e. Long-term operating asset turnover (LTOAT); use total sales and revenues in the numerator
   f. Accounts payable turnover (APT); use machinery and engines COGS
   g. Average payable days outstanding (Accounts Payable/Average Daily COGS)

**Solution**

1. **Profit margins**
   a. Gross profit margin (GPM) ........................................ 19.5% \((\frac{21,048}{16,945})\)
   b. SG&G Expenses / Total Sales and Revenues .............. 10.8% \((\frac{2,470}{22,763})\)

2. **Asset turnovers**
   a. ART (Sales/Average Accounts Receivable) .............. 6.47 times \((\frac{21,048}{3,666})\)
   b. Average collection period ................................. 63.57 days \((\frac{3,666}{21,048})\)
   c. INVT (COGS/Average Inventory) ......................... 5.83 times \((\frac{3,047}{16,945})\)
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- Average inventory days outstanding ................. 65.63 days
- LTOAT (Sales/Average Long-Term Operating Assets) ........ 1.52 times
- APT (COGS/Average Accounts Payable) ................. 6.31 times
- Average payable days outstanding ................. 66.77 days

\[ \text{Average inventory days outstanding} = \frac{\text{Average inventory}}{\text{Sales per day}} \times 365 \]
\[ \text{LTOAT} = \frac{\text{Sales}}{\text{Average Long-Term Operating Assets}} \]
\[ \text{APT} = \frac{\text{COGS}}{\text{Average Accounts Payable}} \]
\[ \text{Average payable days outstanding} = \frac{\text{Average payable}}{\text{Sales per day}} \times 365 \]

LIQUIDITY, SOLVENCY, AND CREDIT ANALYSIS

ROE disaggregation focuses mainly on profitability analysis. Yet, liquidity and solvency are also important in analyzing a company. This later analysis is often put under the umbrella of credit analysis because of the importance of liquidity and solvency for creditors. However, credit analysis is also important for lenders, underwriters, managers of start-ups and growth companies, and even investors (given that creditors enjoy senior standing in liquidation).

Liquidity refers to cash: how much cash the company has, how much cash the company is generating, and how much can be raised on short notice. Moreover, liquidity is a matter of survival since most obligations are settled with cash. Solvency refers to the ability to meet obligations; mainly obligations to creditors, including lessors. Solvency is equally crucial since an insolvent company is a failed company. The following sections introduce measures of liquidity and solvency, and discuss tools and measures of credit analysis.

Liquidity Analysis

This section describes several useful measures in our analysis of liquidity.

Average Cash (Operating) Cycle

The cash (operating) cycle is the period of time from when cash is invested in inventories, until the inventories are sold and receivables are collected. It is the cycle from “cash to cash.” Companies generally want to minimize the cash cycle provided that they achieve acceptable inventory levels and customer credit terms, and that relationships with suppliers are not damaged as a result of excessive “leaning on the trade.” The average cash cycle is measured as follows:

\[ \text{Average cash cycle} = \text{Average collection period} + \frac{\text{Modified Average Inventory Days Outstanding}}{\text{Sales}} - \frac{\text{Modified Average Payable Days Outstanding}}{\text{Sales}} \]

The modified measures refer to their computation using sales in the denominator instead of cost of goods sold. This allows for the summation of days outstanding.

For 3M, the average collection period is 53 days, the modified average inventory days outstanding is 37 days, and the modified average payable days outstanding is 20 days. 3M’s average cash cycle (modified to compute all ratios based on sales) follows:

\[ \text{Average cash cycle} = 53 + 37 - 20 = 70 \text{ days} \]

This means 3M takes about 70 days to convert its cash to inventories, then to receivables, and finally back into cash. Over the past five years, 3M has been able to reduce its cash cycle from 91 days in 1999 to 70 days in 2003. This is a marked improvement. The quicker a company is able to cycle from cash to cash, the greater is its cash flow. Its aim, therefore, is to optimize, not necessarily minimize, investment in receivables, inventories, and payables. Not extending
credit and not having goods available for sale would minimize receivables and inventories, but this would be counterproductive. So, the aim is not to minimize but to optimize receivables, inventories and payables so as to maximize shareholder value. This is known as working capital management.

**Current Ratio**

Current assets are those assets that a company expects to convert into cash within the next year (or operating cycle if longer than one year). Current liabilities are those liabilities that a company expects to mature within the next year (or operating cycle if longer than one year). Companies typically desire more current assets than current liabilities as that implies more expected cash inflows than cash outflows in the short run.

One measure of liquidity is the relative magnitude of current assets and current liabilities. The difference between them is net working capital. However, since the dollar amount of net working capital is difficult to compare across companies of different sizes, the current ratio is often used. It is computed as follows:

$$\text{Current Ratio} = \frac{\text{Current Assets}}{\text{Current Liabilities}}$$

A current ratio greater than 1.0 implies positive net working capital. In general, companies prefer more liquid assets to less and a higher current ratio to a smaller one. (A too high current ratio is possible, and is indicative of inefficient asset use.) A current ratio less than 1.0 is not always bad for at least two reasons:

1. A cash-and-carry company (like a grocery store where payment is typically made in cash) can have consistently large operating cash inflows and potentially few current assets (and a low current ratio), but still be liquid due to those large cash inflows.
2. A company can efficiently manage its working capital by minimizing receivables and inventories and maximizing payables, and still be liquid. Dell Computer and Wal-Mart, for example, use their buying power to exact extended credit terms from suppliers. Further, because both companies are mainly cash-and-carry businesses, their current ratios are less than 1.0 and both are liquid.

The aim of current ratio analysis is to discern if a company is having, or is likely to have, difficulty meeting short-term obligations. In the case of 3M, its current ratio stands at a healthy 1.52 in 2003. Over the past five years, it has fluctuated within a range of 1.34 to 1.59.

**Quick Ratio**

The quick ratio is a variant of the current ratio. It focuses on current assets that are considered quick assets, which are those assets likely to be converted to cash within a short period of time. Quick assets generally include cash, marketable securities, and accounts receivable; it excludes inventories and prepaid assets. The quick ratio follows:

$$\text{Quick Ratio} = \frac{(\text{Cash} + \text{Marketable Securities} + \text{Accounts Receivables})}{\text{Current Liabilities}}$$

The quick ratio reflects a company’s ability to meet its current liabilities without liquidating inventories that could require markdowns. It is a more stringent test of liquidity compared to the current ratio.

3M’s quick ratio is 0.90 as of 2003. Over the past five years, 3M’s quick ratio has ranged from 0.67 to its current level of 0.90.
Solvency Analysis

Solvency analysis is aided by financial leverage ratios. Financial leverage refers to the extent of borrowed funds in a company’s capital structure. We examine financial leverage ratios for insight into company solvency, that is, the risk of bankruptcy. We consider several ratios in addition to FLEV, which we discussed in connection with ROE disaggregation.

Debt-to-Equity

One common measure of financial leverage is the ratio of debt-to-equity, which is defined as:

\[
\text{Debt-to-Equity} = \frac{\text{Total Liabilities}}{\text{Stockholders’ Equity}}
\]

A higher debt-to-equity ratio reflects a greater proportion of debt in a company’s capital structure. 3M’s debt-to-equity ratio has fluctuated from 1.21 to 1.56 in the past five years. It currently sits at the lower end of this range at 1.23.

Long-Term Debt-to-Equity

Another common measure of leverage is long-term debt-to-equity. It focuses on long-term financing and is defined as follows:

\[
\text{Long-Term Debt-to-Equity} = \frac{\text{Long-Term Debt}}{\text{Stockholders’ Equity}}
\]

This ratio implicitly assumes that current liabilities are covered by current assets and, thus, only long-term debt must be funded from operating cash flows. Accordingly, it is important to examine long-term debt relative to the stockholders’ investment.

3M’s long-term debt-to-equity ratio has fluctuated between 0.15 and 0.36 during the past five years, and the company has a conservative level of 0.22 as of 2003. The marked difference between 3M’s debt-to-equity ratio of 1.23 and its long-term debt-to-equity ratio of 0.22 relates to the concentration of its liabilities in short-term non-interest-bearing debt. This is a consequence of 3M’s aggressive working capital management program.

Times Interest Earned

Another useful perspective on solvency analysis is to compare operating flows to liabilities. One approach considers how much income is available to service debt given the debt level and its repayment terms. A common measure is times interest earned, defined as follows:

\[
\text{Times Interest Earned} = \frac{\text{Earnings before Interest and Taxes}}{\text{Interest Expense}}
\]

The numerator is similar to net operating profits after-tax (NOPAT), but it is pre-tax instead of after-tax. Times interest earned reflects the income available to pay interest expense in relation to interest requirements.

Management wants this ratio to be reasonably high so that there is little risk of default. 3M’s times interest earned is robust and currently stands at 65 times. This reflects a comfortable margin of coverage and is at the second highest level in the past five years.

Operating Cash Flow to Liabilities

Another variation in comparing operating flows to liabilities is to examine the operating cash flow to liabilities ratio, defined as:

\[
\text{Operating Cash Flow to Liabilities} = \frac{\text{Net Cash Flow from Operations}}{\text{Total Liabilities}}
\]
This ratio links operating cash flows with the debt level. Companies prefer this ratio to be higher rather than lower.

3M’s operating cash flow to total liabilities ratio is 0.39 as of 2003. Further, it has fluctuated from a low of 0.29 to a high of 0.41 over the past five years.

Overall, there are several variations in leverage ratios. The basic idea is to construct measures that best reflect a company’s credit risk exposure. There is no best financial leverage ratio. As with all ratios, there are several variations in formulas and approaches. Still, to be sure we are measuring the risk we wish to measure, we must compute ratios ourselves from raw data and not rely on financial reporting services whose definitions are uncertain, inappropriate, and sometimes wrong.

Bankruptcy Prediction

Lenders, bankers, and debt raters are concerned with default risk, which is the risk a company is unable to honor its debt obligations. One way to assess this risk is to review a company’s financial characteristics in relation to prior experience with bankrupt companies. Statistical models often aid in this process and are used to draw inferences on the degree of financial distress.

A well-known model of financial distress is Altman’s Z-score. Altman’s Z-score uses multiple ratios to get a predictor of financial distress. This predictor classifies or predicts the likelihood of bankruptcy or nonbankruptcy. Five financial ratios makeup the Z-score:

\[
X_1 = \frac{\text{Working Capital}}{\text{Total Assets}} \\
X_2 = \frac{\text{Retained Earnings}}{\text{Total Assets}} \\
X_3 = \frac{\text{Earnings before Interest and Taxes}}{\text{Total Assets}} \\
X_4 = \frac{\text{Shareholders’ Equity}}{\text{Total Liabilities}} \\
X_5 = \frac{\text{Sales}}{\text{Total Assets}}.
\]

In brief, \(X_1\) reflects liquidity, \(X_2\) reflects cumulative retained profitability, \(X_3\) reflects profitability, \(X_4\) reflects leverage, and \(X_5\) reflects total asset turnover.

The Altman Z-score is computed as:

\[
Z\text{-score} = (0.717 \times X_1) + (0.847 \times X_2) + (3.107 \times X_3) + (0.420 \times X_4) + (0.998 \times X_5)
\]

The Z-score is then interpreted as follows:

- \(Z\text{-score} < 1.20\) → high probability of bankruptcy
- \(Z\text{-score} > 2.90\) → low probability of bankruptcy
- \(1.20 \leq Z\text{-score} \leq 2.90\) → gray or ambiguous area.\(^{10}\)

Another source of data on default risk is information services. For example, Standard & Poor’s, which sells debt ratings, uses several accounting ratios to assess default risk (S&P Compustat also provides the Z-score for companies). A discussion of debt ratings and accounting ratios is in Module 7.

■ LIMITATIONS OF RATIO ANALYSIS

The quality of financial statement analysis depends on the quality of financial information. Analysis cannot be blindly conducted because of various accounting conventions and the flexibility afforded companies in preparing financial statements. Instead, any analysis must be aware of GAAP limitations, the current company environment, competitive pressures, and structural and strategic company changes. This section discusses some of the factors that can limit the usefulness of financial accounting information for ratio analysis.

\(^{10}\)The model here is from Altman, *Corporate Financial Distress* (New York: John Wiley, 1983), pp. 120–124. This model is more generalizable than his earlier 1968 model that can only be applied to publicly traded companies.
Module 3: Analyzing and Interpreting Financial Statements

GAAP Limitations

Several limitations in GAAP can distort financial ratios. They include the following:

1. **Measurability.** Financial statements reflect what can be reliably measured. This results in nonrecognition of some assets, generally items that confer a competitive advantage, and are internally developed. Examples are brand value, a superior management team, employee skills, and a superior supply chain.

2. **Noncapitalized costs.** Related to measurability is the expensing of assets that cannot be identified with enough precision to warrant capitalization. Examples are brand equity costs from promotional activities, and research and development costs on future products.

3. **Historical costs.** Assets and liabilities are typically recorded at original acquisition or issuance costs. Subsequent increases in value are not recorded until realized, and declines in value are only recognized if deemed permanent.

There are other limitations that we subsequently discuss throughout later modules.

Company Changes

Many companies acquire and divest subsidiaries with regularity. Such changes impair the comparability of company ratios across time. Companies also change strategies, such as product pricing, R&D, and financing. We must understand the effects of such changes on ratio analysis and accordingly adjust our inferences.

Companies also behave differently at different points in their life cycles. Specifically, growth companies possess a different profile than do mature companies. Also, seasonal effects can markedly impact analysis of financial statements at different times of the year.

Impact of Conglomerates

Most companies are blends of several businesses. Many consist of a parent company and multiple subsidiaries, often pursuing different lines of business. Several manufacturers, for example, have a finance subsidiary, like the GMAC subsidiary for General Motors. Financial statements of such companies are a combination (consolidation) of the financial statements of the parent and its subsidiaries. Consequently, such consolidated statements impair comparability with other competitors.

Analysis of these conglomerates is difficult and often requires breaking them apart into their component businesses and separately analyzing each line of business. Fortunately, some financial information for major lines of business are provided in the 10-K report, but these disclosures are limited.

A Means to an End

Too many individuals compute and examine ratios in their analysis as if such ratios are reality. Ratios are not reality, but they reflect reality. Reality is the innumerable transactions and events that occur each day between a company and various parties. Reality also is a company’s marketing and management philosophies, its human resource activities, its financing activities, its strategic initiatives, and its product management. In our analysis we must learn to look through the numbers and ratios to better understand the operational factors that drive financial results. Our overriding purpose in analysis is to understand the past and present to better predict the future.

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**MODULE-END REVIEW**

Refer to Mid-Module Review 1 for the financial statements of Caterpillar, Inc.

**Required**

Using Caterpillar’s financial information, compute the following for 2003.
1. Liquidity measures
   a. Average cash operating cycle for machinery and engines
   b. Current ratio
   c. Quick ratio
2. Solvency measures
   a. Debt-to-equity
   b. Long-term debt-to-equity
   c. Times interest earned
   d. Operating cash flow to liabilities (note: CAT’s net cash flows from operating activities in 2003 is $2,066 million)
3. What insights do you draw about Caterpillar’s liquidity and solvency from the analytical measures in parts 1 and 2?

Solution
1. a. Cash cycle
   Average collection period ................. 63.57 days $3,666/($21,048/365)
   Modified average inventory days outstanding ............... 52.84 days $3,047/($21,048/365)
   Modified average payable days outstanding ............... (53.76) days $3,100/($21,048/365)
   Average cash cycle ......................... 62.65 days 63.57/1.33
   b. Current ratio .............................. 1.33 $16,791/$12,621
   c. Quick ratio ............................... 0.92 ($342 + $3,666 + $7,605)/$12,621
2. a. Debt-to-equity .............................. 5.00 $30,387/$6,078
   b. Long-term debt-to-equity .................. 2.32 ($30,387 – $12,621)/$6,078
   c. Times interest earned ..................... 3.06 times* ($1,477 + $246 + $470)/($246 + $470)
   d. Operating cash flow to liabilities .............. 0.07 $2,066/$30,387
   *Many analysts would properly add the $30.77 million profit from affiliated companies to the numerator, computed as $20/(1–0.35) assuming a 35% tax rate. This gives a times interest earned of 3.11.

3. The average cash cycle is 62.7 days. This is a reasonably quick conversion from cash-to-cash. John Deere (a competitor), for example, reports a cash-to-cash cycle of 70 days for the same period. Both of these computations are on trade receivables and inventories only and do not include the receivables and inventories arising from long-term financing of equipment sales through their respective financial subsidiaries. CAT’s current ratio of 1.33 is also reasonably strong as is its quick ratio of 0.92. Neither ratio indicates liquidity problems.

   CAT’s debt-to-equity and long-term debt-to-equity ratios are fairly high and reflect the long-term financing related to its leasing operations. Remember, CAT finances a substantial portion of its equipment sales via its captive finance subsidiary. The balance sheet of that subsidiary, which is consolidated with the manufacturing company parent, is similar to a bank balance sheet (meaning that it is highly leveraged and reliant on a relatively small spread of lease returns over the cost of the financing to support the leasing activities). Given CAT’s adequate times interest earned ratio, our concern with CAT’s financial leverage is moderated.

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**APPENDIX 3A**

**Vertical and Horizontal Analysis**

Companies come in all sizes, which presents difficulties in comparing the numbers in financial statements across such companies. There are several methods that attempt to overcome this hurdle. **Vertical analysis** is one way to overcome size differences. Its approach is to express the financial statements in ratio form. Specifically, it is common to express income statement items as a percentage of net sales and all balance sheet items as a percentage of total assets. Such a ratio-formed financial statement is prepared by dividing each individual financial statement amount under analysis by its base amount as follows:

\[
\text{Common-Size Percent } \% = \frac{\text{Analysis Period Amount}}{\text{Base Period Amount}} \times 100
\]

The resulting **common-size financial statements** facilitate comparative analysis across companies of different sizes, and help highlight any changes in strategies or operations across time. The common-size balance sheet and income statement for **3M Company** are presented in Exhibits 3A.1 and 3A.2.
### EXHIBIT 3A.1 ■ 3M Common-Size Balance Sheet

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<thead>
<tr>
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<tbody>
<tr>
<td><strong>December 31</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cash</td>
<td>$1,836</td>
<td>$618</td>
<td>$616</td>
<td>10.43%</td>
<td>4.03%</td>
<td>4.22%</td>
</tr>
<tr>
<td>Receivables</td>
<td>2,714</td>
<td>2,527</td>
<td>2,482</td>
<td>15.42%</td>
<td>16.49%</td>
<td>16.99%</td>
</tr>
<tr>
<td>Inventories</td>
<td>1,816</td>
<td>1,931</td>
<td>2,091</td>
<td>10.32%</td>
<td>12.60%</td>
<td>14.32%</td>
</tr>
<tr>
<td>Other current assets</td>
<td>1,354</td>
<td>983</td>
<td>1,107</td>
<td>7.69%</td>
<td>6.41%</td>
<td>7.58%</td>
</tr>
<tr>
<td>Total current assets</td>
<td>7,720</td>
<td>6,059</td>
<td>6,296</td>
<td>43.86%</td>
<td>39.53%</td>
<td>43.11%</td>
</tr>
<tr>
<td>Property, plant and equipment, net</td>
<td>5,609</td>
<td>5,621</td>
<td>5,615</td>
<td>31.87%</td>
<td>36.67%</td>
<td>38.44%</td>
</tr>
<tr>
<td>Investments</td>
<td>218</td>
<td>238</td>
<td>275</td>
<td>1.24%</td>
<td>1.55%</td>
<td>1.88%</td>
</tr>
<tr>
<td>Intangibles</td>
<td>2,693</td>
<td>2,167</td>
<td>1,250</td>
<td>15.30%</td>
<td>14.14%</td>
<td>8.56%</td>
</tr>
<tr>
<td>Deposits and other assets</td>
<td>1,360</td>
<td>1,244</td>
<td>1,170</td>
<td>7.73%</td>
<td>8.12%</td>
<td>8.01%</td>
</tr>
<tr>
<td>Total assets</td>
<td>17,600</td>
<td>15,329</td>
<td>14,606</td>
<td>100.00%</td>
<td>100.00%</td>
<td>100.00%</td>
</tr>
<tr>
<td>Notes payable</td>
<td>1,202</td>
<td>1,237</td>
<td>1,373</td>
<td>6.83%</td>
<td>8.07%</td>
<td>9.40%</td>
</tr>
<tr>
<td>Accounts payable</td>
<td>1,087</td>
<td>945</td>
<td>753</td>
<td>6.18%</td>
<td>6.16%</td>
<td>5.16%</td>
</tr>
<tr>
<td>Accrued liabilities</td>
<td>436</td>
<td>411</td>
<td>539</td>
<td>2.48%</td>
<td>2.68%</td>
<td>3.69%</td>
</tr>
<tr>
<td>Income taxes</td>
<td>880</td>
<td>518</td>
<td>596</td>
<td>5.00%</td>
<td>3.38%</td>
<td>4.08%</td>
</tr>
<tr>
<td>Other current liabilities</td>
<td>1,477</td>
<td>1,346</td>
<td>1,248</td>
<td>8.39%</td>
<td>8.78%</td>
<td>8.54%</td>
</tr>
<tr>
<td>Total current liabilities</td>
<td>5,082</td>
<td>4,457</td>
<td>4,509</td>
<td>28.88%</td>
<td>29.08%</td>
<td>30.87%</td>
</tr>
<tr>
<td>Long-term debt</td>
<td>1,735</td>
<td>2,140</td>
<td>1,520</td>
<td>9.86%</td>
<td>13.96%</td>
<td>10.41%</td>
</tr>
<tr>
<td>Other long-term liabilities</td>
<td>2,898</td>
<td>2,739</td>
<td>2,491</td>
<td>16.47%</td>
<td>17.87%</td>
<td>17.05%</td>
</tr>
<tr>
<td>Total liabilities</td>
<td>9,715</td>
<td>9,336</td>
<td>8,520</td>
<td>55.20%</td>
<td>60.90%</td>
<td>58.33%</td>
</tr>
<tr>
<td>Common stock, net</td>
<td>9</td>
<td>5</td>
<td>5</td>
<td>0.05%</td>
<td>0.03%</td>
<td>0.03%</td>
</tr>
<tr>
<td>Capital in excess of par</td>
<td>287</td>
<td>291</td>
<td>291</td>
<td>1.63%</td>
<td>1.90%</td>
<td>1.99%</td>
</tr>
<tr>
<td>Retained earnings</td>
<td>14,010</td>
<td>12,748</td>
<td>11,914</td>
<td>79.60%</td>
<td>83.16%</td>
<td>81.57%</td>
</tr>
<tr>
<td>Treasury stock</td>
<td>4,641</td>
<td>4,767</td>
<td>4,633</td>
<td>26.37%</td>
<td>31.10%</td>
<td>31.72%</td>
</tr>
<tr>
<td>Other equities</td>
<td>(1,780)</td>
<td>(2,284)</td>
<td>(1,491)</td>
<td>(10.11%)</td>
<td>(14.90%)</td>
<td>(10.21%)</td>
</tr>
<tr>
<td>Shareholder equity</td>
<td>7,885</td>
<td>5,993</td>
<td>6,086</td>
<td>44.80%</td>
<td>39.10%</td>
<td>41.67%</td>
</tr>
<tr>
<td>Total liabilities and equity</td>
<td>17,600</td>
<td>15,329</td>
<td>14,606</td>
<td>100.00%</td>
<td>100.00%</td>
<td>100.00%</td>
</tr>
</tbody>
</table>

### EXHIBIT 3A.2 ■ 3M Common-Size Income Statement

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Year Ended Dec. 31</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net sales</td>
<td>$18,232</td>
<td>$16,332</td>
<td>$16,054</td>
<td>100.00%</td>
<td>100.00%</td>
<td>100.00%</td>
</tr>
<tr>
<td>Cost of good sold</td>
<td>9,285</td>
<td>8,496</td>
<td>8,749</td>
<td>50.93%</td>
<td>52.02%</td>
<td>54.50%</td>
</tr>
<tr>
<td>Gross profit</td>
<td>8,947</td>
<td>7,836</td>
<td>7,305</td>
<td>49.07%</td>
<td>47.98%</td>
<td>45.50%</td>
</tr>
<tr>
<td>R &amp; D expenditures</td>
<td>1,102</td>
<td>1,070</td>
<td>1,084</td>
<td>6.04%</td>
<td>6.55%</td>
<td>6.75%</td>
</tr>
<tr>
<td>Selling, general &amp; admin exp</td>
<td>4,132</td>
<td>3,720</td>
<td>3,948</td>
<td>22.66%</td>
<td>22.78%</td>
<td>24.59%</td>
</tr>
<tr>
<td>Operating Income</td>
<td>3,713</td>
<td>3,046</td>
<td>2,273</td>
<td>20.37%</td>
<td>18.65%</td>
<td>14.16%</td>
</tr>
<tr>
<td>Interest expense</td>
<td>56</td>
<td>41</td>
<td>87</td>
<td>0.31%</td>
<td>0.25%</td>
<td>0.54%</td>
</tr>
<tr>
<td>Income before taxes</td>
<td>3,657</td>
<td>3,005</td>
<td>2,186</td>
<td>20.06%</td>
<td>18.40%</td>
<td>13.62%</td>
</tr>
<tr>
<td>Income taxes</td>
<td>1,202</td>
<td>966</td>
<td>702</td>
<td>6.59%</td>
<td>5.91%</td>
<td>4.37%</td>
</tr>
<tr>
<td>Minority interest income</td>
<td>52</td>
<td>65</td>
<td>54</td>
<td>0.29%</td>
<td>0.40%</td>
<td>0.34%</td>
</tr>
<tr>
<td>Net income</td>
<td>2,403</td>
<td>1,974</td>
<td>1,430</td>
<td>13.18%</td>
<td>12.09%</td>
<td>8.91%</td>
</tr>
</tbody>
</table>
Module 3: Analyzing and Interpreting Financial Statements

3M’s total assets in dollars have increased by 26% since 1999. However, it is the composition of the balance sheet, the proportion invested in each asset category, that we are interested in. Liquidity has generally improved as cash now represents 10.43% of total assets, up from 4.22% in 2001. Yet, not all of that cash is sitting in 3M’s checking account. GAAP categorizes cash and cash equivalents in the same account, the latter being temporary investments. Why would 3M build such liquidity? Perhaps, it desires the capacity to quickly react to strategic moves by competitors and to be able to quickly take advantage of investment opportunities, like the acquisition of a company.

The increased accounts receivable and inventory turnover are evidenced in their reduced proportion of total assets. Receivables now constitute 15.4% of total assets, down from nearly 20% in 2000 (not shown). Also, inventories make up 10.3% of total assets compared with 14.3% in 2001.

It is interesting that plant assets (net) have decreased as a percentage of total assets, from 38.4% in 2001 to 31.9% in 2003. Yet, this category of assets has not decreased (in dollars), as purchases of plant assets have equaled depreciation expense. All of the growth in long-term operating assets has resulted from acquisitions, in the form of intangible assets, which were nonexistent five years ago, now constitute 15.3% of total assets.

Total liabilities have not changed appreciably as a percentage of total capitalization—55.2% in 2003 versus 58.3% in 2001. Current liabilities are at a slightly higher level. Stockholders’ equity stands at 44.8% of total capitalization in 2003 versus 41.7% in 2001.

Exhibit 3A.2 shows the common-size income statement. 3M has done a remarkable job of controlling its cost of goods sold. Gross profit is 49.07% of sales in 2003, up from 45.5% in 2001 when McNerney assumed the top job. Also, overhead cost control has reduced SG&A expenses to 22.66% of sales in 2003, versus 24.59% in 2001. R&D expenses are slightly reduced as a proportion of sales and this is somewhat less than positive given the importance of this cost center to 3M’s competitive position and future performance. Finally, 3M is carrying $13.18 cents out of each sales dollar to the bottom line in 2003. This compares favorably with 8.91% in 2001.

Overall, 3M is financially healthy, with high liquidity and relatively low financial leverage, and it is profitable. The operating discipline brought to the company by McNerney is evident in 3M’s control over working capital and operating costs.

Horizontal analysis is the scrutiny of financial data across time. Comparing data across two or more consecutive periods assists in analyzing company performance and in predicting future performance. Horizontal analysis includes examination of absolute dollar changes and percent changes. The dollar change for a financial statement account is computed as follows:

\[
\text{Dollar Change} = \text{Analysis Period Amount} - \text{Base Period Amount}
\]

The percent change (%) for an account is computed as follows:

\[
\text{Percent Change} = \left( \frac{\text{Analysis Period Amount} - \text{Base Period Amount}}{\text{Base Period Amount}} \right) \times 100
\]

The percent change is not interpretable when the base period amount is negative or zero, or when the analysis period amount is negative.

Trend analysis is a type of horizontal analysis. In this case a base period is chosen, and then all subsequent period amounts are defined relative to the base. Specifically, the trend period (%) is defined as follows:

\[
\text{Trend Percent} = \left( \frac{\text{Analysis Period Amount}}{\text{Base Period Amount}} \right) \times 100
\]

Trend percents are often graphed to give a visual representation of the data.

APPENDIX 3B

ROE Disaggregation into Operating and Nonoperating Components

Following is the detailed disaggregation of ROE into its components: RNOA and FLEV × Spread:

\[
\text{ROE} = \frac{\text{NI}}{\text{SE}} = \frac{\text{NOPAT} - \text{NFE}}{\text{SE}} = \frac{\text{NOPAT}}{\text{SE}} \times \frac{\text{NFE}}{\text{SE}}
\]
Module 3: Analyzing and Interpreting Financial Statements

\[
\begin{align*}
\text{RNOA} & = \frac{\text{NI}}{\text{SE}} \\
\text{NFR} & = \frac{\text{FLEV} \times \text{SPREAD}}{\text{SE}} \\
\text{NOA} & = \text{SE} \times \text{RNOA} \\
\text{NOAT} & = \text{SE} \times \text{RNOA} \\
\text{NOPM} & = \text{SE} \times \text{NOPM} \\
\end{align*}
\]

where \( \text{NI} \) is net income, \( \text{SE} \) is average stockholders’ equity, and all other terms are as defined in Exhibit 3.2.

 GUIDANCE ANSWERS

MANAGERIAL DECISION

You Are the Entrepreneur

Your company is performing substantially better than its competitors. Namely, your RNOA of 16% is markedly superior to competitors’ RNOA of 10%. However, RNOA disaggregation shows that this is mainly attributed to your NOAT of 0.89 versus competitors’ NOAT of 0.59. Your NOPM of 18% is essentially identical to competitors’ NOPM of 17%. Accordingly, you want to maintain your NOAT as further improvements are probably difficult to achieve. Importantly, you are likely to achieve the greatest benefit with efforts at improving your NOPM of 18%, which is approximately equal to the industry norm of 17%.

DISCUSSION QUESTIONS

Q3-1. Explain in general terms the concept of return on investment. Why is this concept important in the analysis of financial performance?

Q3-2. (a) Explain how an increase in financial leverage can increase a company’s ROE. (b) Given the potentially positive relation between financial leverage and ROE, why don’t we see companies with 100% financial leverage (entirely nonowner financed)?

Q3-3. Identify two factors that can yield a decline in the gross profit margin. Should a reduction in the gross profit margin always be interpreted negatively? Explain.

Q3-4. When might a reduction in operating expenses as a percentage of sales denote a short-term gain at the cost of long-term performance?

Q3-5. Describe the concept of asset turnover. What does the concept mean and why is it so important to understanding and interpreting financial performance?

Q3-6. How might a company increase its inventory turnover?

Q3-7. How can a company increase its accounts receivable turnover?

Q3-8. By what means might a company increase its long-term operating asset turnover?

Q3-9. Why might a reduction in the accounts payable turnover rate not be considered favorable?

Q3-10. What is the cash cycle? What objective does management have regarding the cash cycle?

Q3-11. What insights do we take away from the graphical relation between profit margin and asset turnover?

Q3-12. Explain the concept of liquidity and why it is crucial to company survival.

Q3-13. Identify at least two factors that limit the usefulness of ratio analysis.

Q3-14.* What are common-size financial statements? What role do they play in financial statement analysis?

MINI EXERCISES

M3-15. Identify and Compute Net Operating Assets and its Components Following is the actual balance sheet for Target Corporation. Identify and compute its net operating assets and its components: net operating working capital and net operating long-term assets.