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In this paper, we demonstrate the use of actual financial data for financial ratio analysis. We construct a financial and industry analysis for Motorola Corporation. The objective is to show students exactly how to compute ratios for an actual company. This paper demonstrates the difficulties in applying the principles of financial ratio analysis when the data are not homogeneous as is the case in textbook examples. We use Motorola as an example because the firm has several segments, two of which account for the majority of sales and represent two industries (semi-conductor and communications) that have different characteristics. The case illustrates the complexity of financial analysis.

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An Example of the Use of Financial Ratio Analysis: The Case of Motorola

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Abstract: In this paper, we demonstrate the use of actual financial data for financial ratio analysis. We construct a financial and industry analysis for Motorola Corporation. The objective is to show students exactly how to compute ratios for an actual company. This paper demonstrates the difficulties in applying the principles of financial ratio analysis when the data are not homogeneous as is the case in textbook examples. We use Motorola as an example because the firm has several segments, two of which account for the majority of sales and represent two industries (semi-conductor and communications) that have different characteristics. The case illustrates the complexity of financial analysis.

MOTOROLA SEGMENT ANALYSIS

Motorola is a global manufacturer of communication products, semiconductors, and embedded electronic solutions. The company is divided into six operating segments that publicly report financial results. The Personal Communication Segment (PCS) designs, manufactures, and markets wireless communication products for service subscribers. Products include wireless handsets, personal 2-way radios, and messaging devices, along with the associated accessories. The Personal Communication Segment accounted for 37.8% of 2002 sales, making it the largest of Motorola's operating segments. The Global Telecommunications Segment (GTS) designs, manufactures, and markets the infrastructure communication systems purchased by telecommunication service providers. Products include electronic exchanges, telephone switches, and base station controllers for various wireless communication standards. This segment accounted for 15.8% of Motorola's sales in 2002. The Broadband Communication Segment (BCS) designs, manufactures, and markets a variety of products to support the cable and broadcast television and telephony industries in delivering high speed data, including cable modems, Internet-based telephones, set-top terminals, and digital satellite television systems. This segment accounted for 7.3% of Motorola's sales in 2002. The Commercial, Government, & Industrial Segment (CGIS) designs, manufactures, and markets integrated communication systems for commercial, government, and industrial applications, typically private 2-way wireless networks for voice and data transmissions, such as would be used by public safety authorities in a community. This segment accounted for 13% of Motorola's sales in 2002. The Semiconductor Product Segment (SPS) designs, manufactures, and markets microprocessors and related semiconductors for use in various end products, such as computers, wireless and broadband devices, automobiles, and other consumer electronic devices. Some of the semiconductors produced are used in products marketed by other Motorola segments. This segment accounted for 16.8% of Motorola's sales in 2002. The Integrated Electronic Systems Segment (IESS) designs, manufactures, and markets automotive and industrial electronic systems, single board computer systems, and energy storage products to support portable electronic devices (such as wireless handsets). This segment accounted for 7.6% of Motorola's sales in 2002.

Condensed Statement of Financial Performance 1998 to 2002

	2002	2001	2000	1999	1998
Sales	26,679	30,004	37,580	33,075	31,340
Net Earnings	(2,485)	(3,937)	1,318	891	(907)

Note: All figures in millions except per share data, as is typical in this report, unless noted.

Total Motorola sales and profitability has varied widely over the last five years. Sales peaked at over \$37B in 2000 and dropped to less than \$27B in 2002. Motorola had a net loss in 2001 and 2002. Motorola's stock price has varied from a high of over \$55 in February of 2000 to a low price of less than \$8 in January of 2003. Despite the losses incurred recently and the variability of reported income, Motorola has continued to pay a steady dividend of \$0.16 per share since 1997. This is a clear indication of the importance that Motorola attaches to the informational content associated with dividends: despite significant losses, dividends have not been reduced. The most recent data indicates that Motorola has returned to profitability, posting a \$0.01 per share profit for the first quarter of 2003.

INDUSTRY ANALYSIS

Value Line classifies Motorola as being part of the semiconductor industry sector, while Yahoo! Finance classifies Motorola as being part of the telecommunications equipment industry segment. Given that four of Motorola's six operating segments (PCS, GTS, BCS, CGIS) design, manufacture, and market telecommunications equipment and account for over 73% of Motorola's sales, telecommunications equipment industry classification seems more appropriate. This paper will use both industries in the presentation. Operating results for both industries are likely to be highly correlated since the semiconductor industry is a major supplier to the telecommunications industry.

The Telecommunications Equipment Industry

The telecommunications equipment industry provides the products required to support land-based and wireless communications: both the end-consumer equipment, and the infrastructure of the networks that enable the end-consumer products. Nokia is market leader in the handset portion of this industry, followed by Motorola, Siemens and Sony-Ericsson. Ericsson leads the infrastructure portion of the equipment industry. The five largest companies are: Cisco Systems, Nokia, Qualcomm, Motorola, and Ericsson, yahoo.marketguide.com.

The telecommunications equipment industry, in particular, has seen difficult operating conditions among the technology industries over the last several years. The difficult operating conditions are the result of two underlying issues. First, after a rapid build up of wireless network infrastructure by the service providers (firms such as Verizon Wireless that provide telecommunication services to the end-consumer) in 2000, the demand for equipment by the service providers dropped some 15% in 2001 and likely dropped by even a higher percentage in 2002, yahoo.finance. Second, the demand for third generation (3G) wireless technologies (which includes mobile data services that can combine voice, data, email, PDA, & other features) has not evolved as quickly as expected. Wireless subscribers have chosen to not replace their handsets with the new 3G technologies in anticipation of the price of the equipment dropping, yahoo.finance.

The telecommunication equipment industry has a beta coefficient of 2.09, explaining in part the difficult operating conditions in the industry as a magnification of the poor conditions in the economy as a whole, yahoo.marketguide.com. A key segment within the telecommunications industry is the wireless handset (cellular phone) segment, both because of its size and because of its visibility to end-consumers. In this wireless handset segment, Nokia is the clear market leader, with a substantial 35.8% market share in 2002 and a strong presence in the critical European market. This is important because Europe is where much of the technological innovation in the industry occurs. Motorola is in second place in this industry segment with a market share of 15.3%, less than half of Nokia's share. Third place belongs to Samsung, with a 9.8% market share, but Samsung's strong technology and significant resources pose significant challenges to Motorola and Nokia's leadership positions. Siemens held an 8.4% market share in 2002, while the joint venture between Sony and Ericsson held a 5.5% market share in the industry segment, Reiter (2003).

The Semiconductor Industry

The semiconductor industry provides the semiconductor "chips" which are integral to consumer electronics such as PC's; PDA's; audio, visual and entertainment equipment, and cellular phones. These chips are also used in commercial electronics such as network servers, communication switch equipment, industrial controls. Intel is the largest firm in the industry. Intel is known in particular for supplying the microprocessors used in PC's. The top 5 companies in this industry in order of descending market capitalization are: Intel, Texas Instrument, Taiwan Semiconductor, Advanced Materials, and ST-Microelectronics, yahoo.marketguide.com.

The semiconductor industry experienced a record year in 2000 with worldwide sales of \$200B. Sales experienced a significant decline in 2001, down some 30% to \$140B. The decline in 2001 was attributed to weak sales in nearly every consumer electronics segment and to weak sales in commercial electronic segments resulting in low demand for semiconductors, yahoo.finance. The year 2002 brought only a slight recovery in the semiconductor industry, with expected worldwide sales increase likely to be only several percentage points higher than 2001 levels. November 2002 sales, only increased by 1.3%, less than the 1.8% increase in October 2002. This low increase is significant because November sales have historically averaged larger increases as electronic manufacturers prepare for the holiday season, Value Line, January 17, 2003, p 1051. The semiconductor industry has a Beta coefficient of 2.17, and, like the telecommunication equipment industry, this explains in part the severe downturn in the industry as the entire economy took a downturn over the last several years, yahoo.marketguide.com.

FINANCIAL RATIO ANALYSIS

Financial ratios for Motorola, for the semiconductor industry, and for the telecommunications industry are provided below. The firms in the semiconductor industry subset represent 87% of the estimated total semiconductor industry sales of \$100 billion in 2002, Value Line, January 3, 2003, pp 744, 770. The firms telecommunications equipment industry represent in 91% of telecommunication equipment industry sales of \$277 billion in 2002, Value Line, January 17, 2003, p 1051.

Evaluating Motorola relative to the semiconductor industry, we first note that Motorola is slightly less liquid than the average firm in the industry, with both a current ratio and a quick ratio that is lower than the industry average. Motorola's average collection period, at 61 days, is lower than the industry average of 50 days, indicating Motorola should evaluate its credit policies. Both fixed asset turnover and total asset turnover are above the semiconductor industry averages, indicating that Motorola is using its assets more efficiently than the industry average in generating sales. Motorola's debt ratio and debt to equity ratio indicate that Motorola is more leveraged than the average firm in the industry. This higher leverage in part explains Motorola's poor financial performance relative to the semiconductor industry because the leverage commits Motorola to interest payments that must be paid regardless of economic and market conditions. The ratios indicate that Motorola has a higher cost of sales than the average firm in the semiconductor industry, resulting in a lower gross profit margin, and higher indirect costs, resulting in lower net profit margin performance relative to the semiconductor industry.

2002 Ratio Analysis

	Motorola	Semiconductor Industry	Telecommunication Equipment Industry
Current Ratio	1.77	2.44	1.52
Quick Ratio	1.47	2.08	1.23
Average Collection Period	61 days	50 days	73 days
Inventory Turnover	6.25	6.01	5.66
Fixed Asset Turnover	4.37	1.58	6.24
Total Asset Turnover	0.86	0.61	0.90
Debt Ratio	0.64	0.34	0.65
Debt to Equity Ratio	1.77	0.52	1.82
Times Interest Earned	NA	NA	NA
Gross Profit Margin	32.76%	37.49%	29.52%
Net Profit Margin	-9.31%	-3.00%	-1.24%
Return on Investment	-7.98%	-1.82%	-1.11%
Return on Equity	-22.11%	-2.78%	-3.14%
Assets / Equity	2.77	1.52	2.82

The situation is different when evaluating Motorola relative to the telecommunications equipment industry, and, considering that the majority of Motorola's business is in this industry rather than the semiconductor industry, this is the more interesting and relevant story. Relative to the telecommunications equipment industry, Motorola has a better liquidity position, with both the current ratio and the quick ratio being higher than the industry average. Motorola collects receivables quicker than the average firm in this industry. Relative to this industry, Motorola may want to evaluate credit policies to determine if perhaps strict credit policies are negatively impacting sales. Motorola uses its total assets slightly less efficiently than the average firm in the telecommunications equipment industry and its fixed asset turnover is significantly less than the industry average, at 4.37 compared to the industry average of 6.24. Motorola is more highly leveraged than the average firm in the telecommunications industry. Motorola may want to examine its capital structure policy to ensure it has the right balance of benefit from the tax shield of increased debt relative to the bankruptcy and related financial distress costs associated with increased debt.

Several explanations are possible for the deviation from industry norms. Perhaps this is the result of a conscious choice to invest heavily in technology and automation in its manufacturing processes (as opposed to a more labor-intensive manufacturing strategy); while such fixed investments will yield significant gains in good market conditions, the investments commit the firm to fixed costs (depreciation) in bad economic conditions. Alternatively, the poor fixed asset turnover may indicate overcapacity caused by extremely poor forecasts of future sales. Or, the poor ratio may indicate a fundamental inability or inefficiency in using the deployed assets. Motorola is slightly less leveraged, with a lower debt and debt-to-equity ratio. Keep in mind, though, that the debt ratios used in the ratio analysis above used total liabilities as a measure of debt. In contrast, capital structure analysis focuses specifically on long-term debt in calculating leverage.

Motorola has a higher gross profit margin than the average firm in the telecommunications equipment industry (32.8% versus 29.5%), but has a lower net margin. Motorola a higher fixed and indirect cost structure. As an illustration of the potential fixed and indirect cost issues, consider the productivity, for this purpose defined as sales per employee, of Motorola relative to its chief

competitor in the telecommunications equipment industry, Nokia. In 2001, Motorola generated sales of \$31,191M with 111,000 employees, for a productivity of \$0.27M per employee. In contrast, Nokia generated sales of \$27,645M with just 53,800 employees, for a productivity of \$0.53M per employee, nearly double the productivity of Motorola. Clearly, Motorola has significant costs associated with its level of employment that are not being returned in sales. This is interesting because Motorola, as observed earlier, also has poor fixed asset use in addition to this effective and / or efficient use of human assets. Perhaps contributing to the poor fixed and indirect cost structure is that Motorola has elements of being a conglomerate that most of the other firms in the industry do not have. Motorola is involved in diverse business segments – telecommunications, semiconductors, automotive components, and batteries, to name a few – and must evaluate whether the administrative and infrastructure costs of managing these diverse segments are less than the benefits of having the segments under one corporate umbrella. It is not obvious that the diverse business segments within Motorola are being used synergistically to increase overall value. If there are not synergies between the business segments, Motorola shareholders should prefer that Motorola divest the segments as investors can diversify their portfolios more efficiently than Motorola can. Most of the other firms in the industry do not have to absorb the costs associated with managing such diverse business activities.

Dupont System of Financial Analysis

A Dupont analysis of Motorola, the semiconductor industry, and the telecommunications equipment industry is shown in the table below. The story told by the Dupont analysis is similar to the story told by analyzing ratios: Motorola must focus on controlling operating costs. Relative to the semiconductor industry as a whole, Motorola has an advantage in its leverage ratio (Assets to Equity of 2.77 compared to 1.52 for the industry) and in its use of assets (Total Asset Turnover of 0.86 compared to 0.61), yet has a poorer return on equity due to its low net profit margin. While one would expect a somewhat lower net profit margin for a firm with a higher leverage ratio (the firm has to pay interest to service the debt that gives the higher leverage ratio), in the Motorola case there are apparently other operational inefficiencies impacting the net profit margin because the overall return on equity is less than the industry average. A similar story, though not quite as obvious, is told by comparing Motorola to the telecommunications equipment industry averages for the Dupont analysis, where Motorola again stands out as being deficient in its ability to generate profits from its sales.

	Motorola	Semiconductor Industry	Telecommunication Equipment Industry
ROE (Return on Equity)	-22.11%	-2.78%	-3.14%
=	=	=	=
NPM (Net Profit Margin)	-9.31%	-3.00%	-1.24%
X	X	X	X
TAT (Total Asset Turnover)	0.86	0.61	0.90
X	X	X	X
A/E (Assets/Equity)	2.77	1.52	2.82

Figure 1 (available upon request) shows the Return on Asset (ROA) portion of the Dupont analysis

$$\text{ROE} = \text{NPM} * \text{TAT} * \text{A/E} = \text{ROA} * \text{A/E} \quad (1)$$

and helps to illustrate Motorola's situation. Large variable and fixed expenses (relative to the level of sales) are negatively impacting ROA, and these expenses, especially variable expenses (selling, general, and administrative expenses) since they are perceived to be more easily controllable, need to be closely evaluated. Increases in sales revenues may also help the ROA situation. Although poor overall market conditions can be blamed for a portion of Motorola's low sales figure, Motorola also needs to critically evaluate why it has lost market share in some of its key business areas over the last several years (for example, Nokia's and Samsung's market share in wireless handsets has improved while Motorola's has declined) making the operating results from poor market conditions even worse. The impact of Motorola's decision early in the lifecycle of the cellular industry not to participate in developing digital cellular technology likely opened the door for firms such as Nokia to gain significant market positions, and Motorola's sales – and its financial position - still suffer from this decision. New product development investments must be closely evaluated to assure that Motorola is developing products that will be valued in the marketplace. However, competitors will not simply let Motorola gain sales and market share at their expense. Nokia capitalized on Motorola's incorrect earlier strategic decision to forego entry in the digital wireless handset arena. Nokia gained a dominant position in Europe and is now clearly aiming to challenge Motorola's leadership in CDMA wireless handset technology in the United States through the introduction of multiple new handset models based on the CDMA technology prevalent in America, *Nokia Unveils New Phones to Crack CDMA*. Motorola – and – are also losing share in foreign markets, such as China, because domestic firms in those markets use price advantages to drive sales, *Nokia, Motorola Lose China*

Market Share to Domestic Companies Motorola must develop a product and business strategy to increase sales in the midst of these threats while at the same time controlling variable and fixed expenses.

Short Term Liquidity Management

The telecommunication equipment industry averages a current ratio of 1.52 and a quick ratio of 1.23, so Motorola's current ratio and quick ratio of 1.77 and 1.47, respectively, compares favorably to the industry. This, combined with the observation that both ratios are above one, leads to the conclusion that Motorola is in a solid short-term liquidity position.

While this favorable absolute liquidity position is important, perhaps just as important to debt investors in Motorola is the trend over time in the ratios. In Motorola's case, there have been very solid improvements in its liquidity position since 1999 and 2000. Some of this improvement in liquidity comes from reductions in notes payable and the current portion of long-term debt. But a significant portion of the improvement is attributable to large increases in cash and cash equivalents. The cash and cash equivalent balance increased 97% percent during period. In addition to the cash increases seen above, Motorola has very recently taken additional steps to "further boost" its cash position by selling \$325M of Nextel stock, *Motorola Sells \$325M of Nextel Stock*. This sale of 25 million of Motorola's 108 million Nextel shares was completed "to realize the price appreciation of some of its investment in the wireless communications services provider and to enhance its *already strong cash position*," *Motorola Completes Sale of 25 Million of Its 108 Million Shares of Nextel*. After the sale, Motorola will remain one of Nextel's largest shareholders, retaining over a 9% stake in Nextel, *Motorola Sells \$325M of Nextel Stock*.

Since a good deal of a firm's cash balance is to cover expenses related to manufacturing and selling products, and since Motorola's sales have been falling over the last several years, Motorola's cash buildup leads to an interesting question that is difficult to answer using publicly available information: is the build-up of the cash balance appropriate? Or, asked another way, is Motorola currently keeping *too high* of a cash balance since, after all, cash balances do not generate a return for investors? If Motorola was in an extremely poor cash position in 1999 and 2000, perhaps the build-up is appropriate. On the other hand, having too large of a cash balance reduces firm value; for example, keeping 25 million shares of Nextel stock may well enhance firm value more than having the proceeds of the sale sit idle as cash. Perhaps the increase in cash balances is in fact contributing to the decline in firm value observed over the last several years as investors see the cash sitting idle rather than providing at least a risk free market rate of return.

	2002	2001	2000	1999
Cash and cash equivalents	6,507	6,082	3,301	3,537
Short-term investments	59	80	354	699
Accounts receivable, net	4,437	4,583	7,092	5,627
Inventories, net	2,869	2,756	5,242	3,707
Other current assets	3,262	3,648	3,896	4,015
Total current assets	17,134	17,149	19,885	17,585
Notes payable & current portion of long-term debt	1,524	870	6,391	2,504
Accounts payable	2,268	2,434	3,492	3,285
Accrued liabilities	5,913	6,394	6,374	7,117
Total current liabilities	9,705	9,698	16,257	12,906
Current Ratio	1.77	1.77	1.22	1.36
Quick Ratio	1.47	1.48	0.90	1.08
Net Working Capital	7,429	7,451	3,628	4,679

Capital Structure & Debt Management

From this data, it is evident that there has been a significant change in Motorola's capital structure over the last several years. When viewed from either a book value or market value basis there is a *significant increase* in leverage. Motorola's long term debt increased by more than 85% from 2000 to 2001, while equity dropped on both a book value and market value basis. From the data, it does not appear that Motorola has a strict or a tight target debt-equity ratio that they maintain to balance the benefits of debt (primarily, the tax savings due to interest) with the cost of debt (primarily, financial distress costs), unlike many large firms, Graham, and Harvey (2001). It is unclear whether Motorola has a strategy to minimize their weighted average cost of capital.

	2002	2001	2000	1999
Long Term Debt, Book Value (\$M)	7,779	8,857	4,778	3,573
Long Term Debt, Market Value (\$M)	7,722	8,857	4,778	3,573
Stockholders Equity, Book Value (\$M)	11,239	13,691	18,612	18,693
# Shares (M)	2,301	2,213	2,257	2,202
Share Price (\$)	8.01	16.05	19.59	44.72
Stockholders Equity, Market Value (\$M)	18,431	35,523	44,207	98,473
Debt/Equity (Book Value)	0.69	0.65	0.26	0.19
Debt/Equity (Market Value)	0.42	0.25	0.11	0.04
Note: 2001, 2000, 1999 market value of debt assumed same as book value of debt				

Some of the increase in long-term debt from 2000 to 2001 was used to replace short-term debt, Motorola 2001 Proxy Statement. However, we observed earlier that cash balances increased significantly in the same time period, indicating that some of the long-term financing was used to improve the short-term liquidity position. But these improvements in the short-term liquidity position came at the expense of an increase in operating risk. The increased leverage committed the company to increased interest payments to service the long-term debt. Interest payments increased from \$529M to \$844M from 2000 to 2001, increasing Motorola's losses in 2001 as economic and market conditions worsened, Motorola 2001 Proxy Statement. The significant amount of debt added in 2001 could also impact Motorola's ability to acquire long-term debt at favorable rates in the future. If funds are needed beyond which are available internally, Motorola may have no choice but to turn to the equity market, which is generally considered to be unfavorable at this point in time. The increase in long-term debt may, in part, support the free cash flow hypothesis, which asserts that bad investment decisions are often made in the presence of a large amount of free cash flow.

While we have examined Motorola's capital structure from an absolute perspective, it is worthwhile to look at the capital structure relative to the industry segment that Motorola primarily participates in, the telecommunications equipment industry. Company wide financial structure data is as follows:

	Industry
Long Term Debt, Book Value (\$M)	56,346.6
Stockholders Equity, Book Value (\$M)	119,349.3
Stockholders Equity, Market Value (\$M)	270,388.9
Debt/Equity (Book Value)	0.47
Debt/Equity (Market Value)	0.21

Motorola's Debt/Equity ratio on a book value basis is 0.69, which is higher than the industry average of 0.47, and Motorola's Debt/Equity ratio on a market value basis is 0.42, double the industry average of 0.21. So, Motorola has not only increased its leverage, it has increased its leverage well above the industry average leverage ratio. Is this bad, in the sense that the higher leverage level is detracting from firm value? We believe that this question is difficult to answer with information from publicly available sources. The appropriate amount of leverage is unique to each firm based on the firm balancing the tax benefits of increased debt against the financial distress costs associated with increased debt. However, the deviation from the industry average leverage ratio should be closely examined as, on average, other firms in similar business situations see the appropriate balance between the tax shelter benefit and distress costs at much lower levels of leverage.

SUMMARY AND CONCLUSIONS

In this paper, we have shown that financial ratio analysis is complicated for companies that do not readily fall into a single industry. Motorola has six operating units that fall into several industries with two industries accounting for most of the sales – telecommunications and semi-conductor. The differences in the industry characteristics of these two industries complicate the financial ratio analysis of Motorola. However, a more relevant picture of the operating characteristics of Motorola is achieved by increasing the complexity of the analysis, that is, by comparing Motorola to both industries.

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The data tables and sources of data used in this paper are available upon request from Carl B. McGowan, Jr., mcgowan@pkriscc.ukm.my.