Chapter 8: Financial Analysis

In this chapter we will show how the firm's financial statements help you to understand the firm's overall performance and how some key **financial ratios** may indicate potential problems in the operation of the firm. These financial ratios give a snapshot of the current situation of the firm for various aspects.

We can divide the financial ratios in two broad categories:

1. Ratios related to the investment decisions of the firm. In general this category measures the profitability of the firm's current projects and the efficient use of its assets.
2. Ratios related to the financing decisions. The category of ratios measures the riskiness of the financing strategy and the sufficient liquidity provided by it.

The information that we need to calculate the financial ratios are included in the financial statements of the firm. So, we start this chapter by presenting the balance sheet and the income statement.

8.1. Financial statements

To calculate these financial ratios we use the financial statements that provide us the necessary information. These statements include the **balance sheet** and the **income statement**.

8.1.1. The balance sheet

Table 1 reports the balance sheet of IBM at the end of 2014. It provides a snapshot of the asset at the end of the year and the sources of the money that was used to buy these assets.

The first part contains the assets in declining order of liquidity. This means that we first report the assets that are most easily to be turned in cash in the near future. They include cash itself, marketable securities and accounts receivables (net receivables) and inventory of raw materials and finished products. These assets are known as **current assets**.

The remaining assets of the balance sheet consist of long-term investments (i.e., securities that the firm has no intention to sell the following years), the tangible assets of the firm (such as the property, plant and equipment) and finally its intangible assets. The latter include the intangible assets of the firm that can be measured and valued, such as patents and trademarks and goodwill which is the difference between the purchase price and the book value of an acquired firm that is amortized for several years.

Table 1: IBM balance sheet, 2014

Assets	
Current Assets	
Cash And Cash Equivalents	8,476,000
Short Term Investments	-
Net Receivables	33,875,000
Inventory	2,103,000
Other Current Assets	4,967,000
Total Current Assets	49,421,000
Long Term Investments	16,712,000
Property Plant and Equipment	10,771,000
Goodwill	30,556,000
Intangible Assets	3,104,000
Accumulated Amortization	-
Other Assets	2,160,000
Deferred Long Term Asset Charges	4,808,000
Total Assets	**117,532,000**
Liabilities	
Current Liabilities	
Accounts Payable	21,992,000
Short/Current Long Term Debt	5,731,000
Other Current Liabilities	11,877,000
Total Current Liabilities	39,600,000
Long Term Debt	35,073,000
Other Liabilities	27,153,000
Deferred Long Term Liability Charges	3,691,000
Minority Interest	146,000
Negative Goodwill	-
Total Liabilities	105,663,000
Stockholder Equity	
Misc Stocks Options Warrants	-
Redeemable Preferred Stock	-
Preferred Stock	-
Common Stock	52,666,000
Retained Earnings	137,793,000
Treasury Stock	-150,715,000
Capital Surplus	-
Other Stockholder Equity	-27,875,000
Total Stockholder Equity	11,869,000
Total liabilities and stockholder equity	117,532,000

Data are provided by finance.yahoo.com. All numbers in thousand.

The second part of the balance sheet explains where the money to buy the assets came from. We first look at the liabilities, that is, the money that the firm owns. First appear the liabilities that need to be paid off in the near future. These are known as **current liabilities** and include debt that is due to be repaid within the next year and accounts payables. The difference between current assets and current liabilities is known as the **net working capital**. Second come the long-term liabilities (like for example bonds and leases that will not be repaid in the coming year). The final rows of the balance sheet consist of the stockholder's equity. This includes the original proceeds received by the firm when it issued the equity (denoted as common stock), the retained earnings (i.e., the net income of a firm minus the dividends paid out to stockholders) and the book value of treasury stocks (i.e., stocks that were brought back by the firm for a short time period). The balance sheet preserves the following equality:

$$\text{Assets} = \text{Liabilities} + \text{Stockholders equity}$$

Table 2: IBM income statement, 2014

Total Revenue	92,793,000
Cost of Revenue	46,386,000
Gross Profit	46,407,000
Operating Expenses	
Research Development	5,437,000
Selling General and Administrative	22,438,000
Non Recurring	-
Others	-
Operating Income or Loss	18,532,000
Income from Continuing Operations	
Total Other Income/Expenses Net	1,938,000
Earnings Before Interest And Taxes	20,470,000
Interest Expense	484,000
Income Before Tax	19,986,000
Income Tax Expense	4,234,000
Minority Interest	-
Net Income From Continuing Ops	15,752,000
Non-recurring Events	
Discontinued Operations	-3,729,000
Extraordinary Items	-
Effect Of Accounting Changes	-
Other Items	-
Net Income	12,023,000
Preferred Stock And Other Adjustments	-
Net Income Applicable To Common Shares	**12,023,000**

Data are provided by finance.yahoo.com. All numbers in thousand.

8.1.2. The income statement

The income statement shows the profitability of a firm during the previous year. Table 2 reports the income statement of IBM for 2014. The income statement reports the gross profit which is the difference between the total revenues and the costs of goods sold. Then by subtracting the operating expenses we calculate the operating income. We then calculate the net income for continuing operations by taking into account interest expenses, depreciation and taxes. Finally we add (or subtract) any gain (or loss) from unusual events or discontinued operations (for example the loss due to the sale of a significant part of company's business) to calculate the net income.

8.2. Measuring performance

To measure the performance of IBM for its stockholders we will start by comparing the market capitalization (or market cap) of the firm, which is the market value of shareholders equity, with the book value of shareholders equity. This is a comparison between the amount of money that shareholders have invested in IBM all these years and the current value of this investment. At the end of year 2014 the market cap of IBM was close to $147.31 billion. Therefore, the **market value added** is 147.31 – 11.869 = 135.321 billion. So, IBM shareholders have accumulated about $135.321 billion in market value added. Of course this very large extra value is related to the size of the firm. Smaller firms with fewer assets are difficult to create so large market value added. Therefore, financial managers and analysts also calculate how much value has been added for each dollar that shareholders have invested. To do this, they compute the ratio of market value to book value, known as the **market-to-book ratio**. For IBM this is equal to

$$\text{Market-to-book ratio} = \frac{147.310}{11.869} = 12.41$$

In other words, IBM has multiplied the value of its shareholders' investment 12.41 times.

Both of these measures are based on market cap. But market cap depends on the current price of the stock in the market. So, it reflects investors' expectations about the *future* performance of the firm. Investors pay attention to current profits and investment, of course, when the form expectations but measures using market cap can nevertheless be noisy measures of *current* performance. Also, market values fluctuate because of macroeconomic events and factors that are outside the manager's control. Thus, these market values are noisy measures of how well the corporation is performing. To overcome these problems we need to use accounting measures of profitability.

In the income statement a number of costs are deducted from the revenues in order to calculate the net income. But an important cost is not included: the cost of the capital

that the firm has raised from investors. Therefore, in order to examine if the company has truly created value, we need to measure if it has earned a profit after deducting all costs, including the cost of capital.

The cost of capital is actually an opportunity cost of capital, equal to the expected rate of return on an investment in financial markets. The firm creates value for investors only if it can earn more than the cost of capital, that is, more than its investors can earn by investing on their own.

The profit after deducting all costs, including the cost of capital, is called the **economic value added (EVA)**. The EVA is equal to the realized net income for bondholders and stockholders minus the income that these investors expect to receive according to the capital provided to the firm and their required cost of capital. So it is the dollar surplus value created by investing in the firm. That is,[1]

$$\text{EVA} = \big(\text{after-tax interest} + \text{net income}\big) - \text{total capital} \times \text{cost of capital}$$

For example, for IBM the sum of long-term debt and shareholders' equity at the end of 2013 (see Excel file Chapter_8_IBM.xlsx for this information) was $32.856 + 22.792 = 55.648$ billion. Assuming that the cost of capital for IBM is 8%, then investors who provided the 55.648 billion expect the company to earn 4.452 billion the following year.[2] In 2014 the net income of IBM was equal to 12.023 billion and the after-tax interest equals $(1-0.21) \times 0.484 = 0.382$ billion assuming a tax rate of 21%.[3] So, in total stockholders and bondholders receive $12.023 + 0.382 = 12.405$ billion. Thus, the EVA = 12.405 – 4.452 = 7.953 billion. We can re-express EVA as follows:

$$\text{EVA} = \left(\frac{\text{after-tax interest} + \text{net income}}{\text{total capital}} - \text{cost of capital} \right) \times \text{total capital}$$

$$= \big(\text{return on capital} - \text{cost of capital}\big) \times \text{total capital}$$

So, if the **return on capital (ROC)** of the firm is larger than the cost of capital the EVA is positive.

The notion of EVA is very much related to the ROC and how much this exceeds the cost of capital. Thus, we can use the ROC itself and other accounting rates of return (that we have already seen in Chapter 7) to measure firm's return per dollar of investment. Three common return measures are the return on capital (ROC), **the return on equity (ROE)** and **the return on assets (ROA)**. All are based on

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[1] One would define the realized net income for stockholders and bondholders as interest + net income. So why the EVA definition uses the after-tax interest instead of the interest itself? The reason is that a similar adjustment is made in the estimation of the cost of capital. Technically, this is estimated by the after-tax weighted average cost of capital given as $\text{after-tax WACC} = (1-\tau)r_D \dfrac{D}{V} + r_E \dfrac{E}{V}$ where τ is the corporate tax rate, r_D is the cost of debt, r_E is the cost of equity, D is the debt value, E is the equity value and V is the total value of the firm. So, as we subtract the tax advantage of debt for the cost of capital we also do the same for the estimation of the realized net income, so that both terms of the EVA to be comparable. See Chapter 11 for more details on the after-tax WACC.

[2] See https://www.stock-analysis-on.net/NYSE/Company/International-Business-Machines-Corp/DCF/Present-Value-of-FCFF for the estimates of the cost of capital and cost of equity for IBM.

[3] I estimated this effective tax rate, using the data on the income statement, as follows $4.234/19.986 = 21\%$.

accounting information, so they are known as **book rates of return**. As we have already seen the ROC is given as:

$$\text{ROC} = \frac{\text{after-tax interest} + \text{net income}}{\text{total capital}}$$

For IBM this is equal to 12.405/55.648 = 22.3%. The cost of capital is estimated to be equal to 8% so the firm earned close to 14% more than claimholders were expected.

Return on equity (ROE) is defined as the income to shareholders per dollar invested by them. It is given as:

$$\text{ROE} = \frac{\text{net income}}{\text{book value of equity}}$$

For IBM the ROE is equal to 12.023/22.792 = 52.75%. Has the company provided an adequate return to shareholders? To answer that question, we need to compare it with the company's cost of equity. IBM cost of equity capital in 2014 was about 9.87%. So, the company's ROE was close to 40% higher than what shareholders expected to receive.

Return on assets (ROA) measures the income available to debt and equity investors per dollar of the firm's total assets. Total assets equal total liabilities plus shareholders' equity are greater than total capital since the latter does not include current liabilities. It is given as:

$$\text{ROA} = \frac{\text{after-tax interest} + \text{net income}}{\text{total assets}}$$

For IBM this is equal to 12.405/126.223 = 9.82%. We will see later how the ROA is determined by the sales that these assets generate and the profit margin that the company earns on its sales.

Accounting rates of return and EVA have obvious attractions and a number of drawbacks. First, unlike market-based measures of performance, they show current performance and are not affected by the expectations about future events or events that are not firm-specific which are reflected on current market prices. However, the use of book values has its own problems. Accountants do not show all assets in the balance sheet, yet our calculations take accounting data at face value. For example, we ignored that IBM has created value due to research and development, patents and trademarks. All these are intangible assets which are not fully included in the balance sheet. If it were shown, the book values of assets would increase, and IBM would not appear to earn so high returns. Another factor that may explain these high numbers is that all previous years IBM has brought back a large amount of shares, thus decreasing the book value of equity, which in turn increases the accountings rates of return.

8.3. Measuring efficiency

Up to now we have examined various measures of performance for the firm's operations. We are now going to look a little deeper in order to understand why a firm has performed so good or so bad. One factor that contributes to the overall performance of a firm is the efficiency with which it uses its various assets.

One measure of efficiency is the **asset turnover ratio**. It measures how much sales volume is generated by each dollar of total assets. It is defined as:

$$\text{Asset turnover} = \frac{\text{sales}}{\text{total assets (start of year)}}$$

For IBM this is equal to 92.793/126.223 = 73.5%. So, for each dollar invested in total assets the firm generates 73.5 cents of revenues.

The company's success depends not only on the volume of its sales but also on how profitable those sales are. This is also related to the operating efficiency of the firm. This is measured by the **profit margin**. It is defined as the proportion of net income on sales

$$\text{Profit margin} = \frac{\text{net income}}{\text{sales}}$$

For IBM this is equal to 12.023/92.793 = 12.95%. This definition does not take into account that a portion of the revenues from the sales must be paid out as interest. Therefore, it is useful to include the debt interest in the nominator so that a firm does not look less profitable simply because it employs debt finance. This gives an alternative measure of profit margin, known as the **operating profit margin**. This is given as:

$$\text{Operating profit margin} = \frac{\text{after-tax interest} + \text{net income}}{\text{sales}}$$

For IBM this is equal to $((1-0.21)\times 0.484 + 12.023)/92.793 = 13.36\%$.

8.3.1. Analyzing the ROA

We have previously calculated that IBM earns 9.82% on its assets. The following equation shows that this return depends on two factors: (a) the asset turnover and (b) the operating profit margin:

$$\text{ROA} = \frac{\text{after-tax interest} + \text{net income}}{\text{assets}} = \frac{\text{sales}}{\text{assets}} \times \frac{\text{after-tax interest} + \text{net income}}{\text{sales}} =$$
$$= \text{asset turnover} \times \text{operating profit margin}$$

This breakdown of ROA is often called the **Du Pont formula**. This formula helps to understand what causes the reported return on assets. For example, for IBM the asset turnover is 73.5% so one could argue that the assets are not fully efficiently used. On the other hand, the operating margin profit is 13.36% which indicates that a

significant part of the sales revenues are given out as profits to the claimholders of the firm.

8.4. Measuring leverage

When a firm borrows money, it promises to make a series of interest payments and then to repay the amount that it has borrowed. These amounts are certain. If profits increase, bondholders continue to receive these certain cash flows, thus all gains go to shareholders. On the other hand, if profits decrease, bondholders still receive their constant interest payments and shareholders bear all the losses. Thus, debt increases the return to shareholders in good times and reduces them in bad times. For that reason, it is said to create **financial leverage**. Leverage ratios measure how much financial leverage has taken on by the firm. **Long-term debt ratio** measures the proportion of long-term debt to total long-term capital. The higher this ratio, the more leveraged this firm is. It is defined as:

$$\text{Long-term debt ratio} = \frac{\text{Long-term debt}}{\text{Long-term debt} + \text{equity}}$$

For IBM this is equal to $35.073/(35.073 + 11.869) = 74.7\%$. Leverage is also measured by **debt-equity ratio** defined as:

$$\text{Long-term debt-equity ratio} = \frac{\text{long-term debt}}{\text{equity}}$$

For IBM this is equal to $35.073/11.869 = 295\%$.

Notice that these definitions ignore short-term debt. This probably makes sense if short-term debt is temporary or is matched by similar holdings of cash, but if the firm is a regular issuer of short-term debt we can widen the previous definitions to include all firm's liabilities. We define the **total debt ratio** as

$$\text{Total debt ratio} = \frac{\text{total liabilities}}{\text{total assets}}$$

For IBM this is equal to $105.663/117.532 = 90\%$.

The previous ratios measure how the corporation finances the purchase of its assets. They do not, however, measure the ability of the firm to repay its debt. This can be measured by the **times-interest-earned ratio**. It calculates the extent to which interest obligations are covered by earnings. It is given as:

$$\text{Times-interest-earned ratio} = \frac{\text{EBIT}}{\text{interests}}$$

For IBM this is equal to $20.470/0.484 = 42.29$. So, EBIT covers more than 40 times the interest payments of 2014. If in the previous definition of EBIT we add back depreciation (which is a noncash expense) we calculate the **cash coverage ratio**.

Leverage has a role to play on ROE. An extended Du Pont formula for ROE implies that:

$$\text{ROE} = \frac{\text{net income}}{\text{equity}} =$$

$$= \underbrace{\frac{\text{assets}}{\text{equity}}}_{\text{leverage ratio}} \times \underbrace{\frac{\text{sales}}{\text{assets}} \times \frac{\text{after-tax interest} + \text{net income}}{\text{sales}}}_{\text{ROA}} \times \underbrace{\frac{\text{net income}}{\text{after-tax interest} + \text{net income}}}_{\text{debt burden}}$$

The middle term is the ROA. It depends on the assets and operating efficiency of the firm and is unaffected by financial leverage. However, the first and last term do depend on the mix of debt and equity that the firm uses. The first term, denoted as leverage ratio, is equal to 1 + total debt-equity ratio. The last term, denoted as debt burden, measures the proportion by which interest expenses reduces net income. If the firm is entirely financed by equity then these two terms are equal to 1 and the ROE is equal to the ROA. If the firm borrows, however, the leverage ratio exceeds 1 and the debt burden is less than 1. Thus leverage can either increase or decrease ROE. You will usually find that leverage increases ROE especially when the firm is performing well.

8.5. Measuring liquidity

For credit analysts and bank managers it is not only useful to measure the leverage of a specific firm but also to know whether the firm is able to meet its obligations in cash at the time these obligations are due. For this reason they look at several measures of liquidity. Liquid assets can be converted into cash quickly and cheaply. These assets include cash itself, inventories and accounts receivables. On the other extreme, we have illiquid assets such as plants and equipment. Of course more liquidity is not always a good thing. Efficient firms do not leave excess cash in their bank accounts. They don't allow customers to postpose their bills or they don't leave large stocks of finished goods and raw materials in their warehouses. Thus, high levels of liquidity may indicate an inefficient use of capital.

As noted previously the difference between current assets (which are considered as highly liquid) and current liabilities is known as the net working capital. For IBM this is equal to 49.421 – 39.600 = 9.821. We define the **net-working capital-to-total-assets ratio** as the ratio of net working capital to total assets. For IBM this is equal to 9.821/117.532 = 8.35%.

The **current ratio** is the just the ratio of current assets to current liabilities. For IBM this is equal to 49.421/39.600 = 1.25. So, IBM has $1.25 in current assets for every dollar in current liabilities.

Some current assets are more liquid than others. If the firm gets into bad times inventories of finished goods cannot be sold or they would be sold in a very low price. Thus managers exclude inventories and other less liquid components of current assets

when comparing current assets to current liabilities. They focus on cash, marketable securities and accounts receivables. This results in the **quick ratio**:

$$\text{Quick ratio} = \frac{\text{cash} + \text{marketable securities} + \text{receivables}}{\text{current liabilities}}$$

For IBM this is equal to (8.476 + 33.875)/39.600 = 1.07.

If we narrow even more the definition of liquid current assets we define the **cash ratio** which includes only cash and marketable securities. It is given as:

$$\text{Cash ratio} = \frac{\text{cash} + \text{marketable securities}}{\text{current liabilities}}$$

For IBM this is equal to 8.476/39.600 = 0.21. Note here that a low cash ratio may not matter if the firm can borrow on short notice using a guaranteed line of credit from a bank.

8.6. Interpreting financial ratios

After calculating the aforementioned financial ratios you need some way to judge if these are high or low. For some of them, like for example the EVA and the ROC, there is a natural benchmark. If the EVA is negative or the ROC is lower than the cost of capital then the firm has not created wealth for its shareholders. But what about other measures, like for example the asset turnover or the debt ratio?

First, you need to remember that these ratios would not be the same across industries or across companies. High-tech businesses hold huge amount of cash; utilities hold very little. Thus cash and quick ratios would be very high for the former and very low for the latter. Oil companies and utilities invest principally in fixed assets; software and computer manufacturers have mainly current assets. This causes utilities to have high debt ratios in contrast to computer companies. Food retailers can generate high levels of sales from relatively few assets but their operating profit margin is low compared to other firms.

Second, when appraising the financial ratios of a firm it makes sense to limit your comparison to the firm's main competitors. Table 3 reports several financial ratios of IBM and HP (Hewlett Packard).

IBM has performed better than HP the previous year. It has a higher market-to-book ratio, and a higher ROA and ROE. Part of its success is due to the higher operating margin indicating a higher operating efficiency. However, IBM has a very high debt compared to equity. On the other hand, the book value of debt for HP is lower to the book value of equity.

Third, it is also interesting to examine these financial ratios across time. This would provide information about the performance, the efficiency or the leverage of the firm not just for the recent year but also for a longer time period. This can reveal whether or not its performance is temporary due to some unexpected events or persists for a longer time period.

Table 3: Selected financial ratios from IBM and HP

	IBM	HP
Performance Measures		
Market-to-book ratio	10.68	1.93
ROE	95.13%	16.19%
ROA	9.63%	5.14%
Efficiency measures		
Asset turnover	46%	63%
Profit margin	12.98%	4.30%
Operating profit margin	21.01%	8.14%
Leverage measures		
Total debt-equity ratio	280%	93%
Liquidity measures		
Current ratio	1.27	1.06

Data are provided by finance.yahoo.com and correspond to July 2015. I calculated the asset turnover using the ROA and the operating profit margin from the Du Pont formula.

Exercises-8

1. For the US firm used in the first project download the balance sheets and income statements from https://www.sec.gov/ for the last three years. In the search field in the top right part of the website write the name of the company. In the "Selected Filings" choose 10-K and click on the button "View all 10-Ks and 10-Qs". Find the annual reports of the last three years and click on "Filling". Then, follow the steps described in the first project to download the financial statements.

   From Yahoo Finance website you can also find a main competitor of your firm. Write your firm on the search button, and a webpage providing information to your firm will appear. In the field "Compare to: XXX" you can see the main competitors of your firm. Follow the steps above to download the financial statements of this second firm.

   From

   https://pages.stern.nyu.edu/~adamodar/New_Home_Page/datafile/wacc.html

   download the cost of capital (i.e., the after-tax WACC) of the industry that the firms belong. Assume that this is the cost of capital of the two firms.

   Then, calculate all financial ratios of these two firms for the last two years. Compare these results across firms and across time. Comment these results.