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Performance measurement and management with financial ratios: the BASF SE case

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Performance Measurement and Management with Financial Ratios – the BASF SE Case

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Gert Bruche | Christoph Dörrenbächer | Friedrich Nagel | Sven Ripsas

Performance Measurement and Management with Financial Ratios – the BASF SE Case

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Abstract:

This teaching note provides an overview and a technical introduction to the mechanics of financial statement and ratio analysis, and offers an outlook into related areas. The BASF SE financial data 2011 are analyzed to illustrate the techniques of financial performance analysis and discusses action levers to enhance the performance of a business. This teaching note is especially written for undergraduate students in Management Accounting. However, it might serve well as an introduction to strategic performance management on graduate level for students without deep financial or management accounting background.

Zusammenfassung:

Dieser pädagogische Artikel bietet einen Überblick und eine technische Einführung in die Mechanik der Finanz- und Kennzahlenanalyse von Unternehmen. Darüber hinaus wird ein Ausblick in angrenzende Forschungsgebiete aufgezeigt. Zur Verdeutlichung des Konzeptes werden die Zahlen des Jahresberichtes der BASF SE von 2011 analysiert und Hebel zur Verbesserung der Kennzahlen und der Leistung von Unternehmen diskutiert. Der vorliegende Artikel wurde insbesondere für Studierende in der Vertiefung Controlling auf Bachelor-Niveau geschrieben. Er kann allerdings auch gut als Einleitung für strategische Controlling-Fragen für Masterstudierende genutzt werden, die nicht über vertiefte Finanz- bzw. Controllingkenntnisse verfügen bzw. diese auffrischen wollen.

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1. Introduction and learning objectives

Management accounts might be regarded as performance agents helping the company to achieve its desired performance. But what is performance and what are the commonly accepted measures of performance? Financial statements are the condensed performance reports of companies. They are based on the accounting data which form the language of business and are described in line with generally accepted accounting principles (US GAAP, IFRS, HGB, etc.). They can provide the initiated reader (be it as (prospective) shareholder, competitor or employee) with valuable insights about the financial vitality and value of a company.¹ Companies are under scrutiny by banks as well as investors, and subject to performance expectations that are largely expressed in accounting ratios. Graduates in Business Administration and future management accountants need to be able to read, analyze and interpret financial statements in order to prepare and make informed management decisions, and find levers for action to improve the company's performance.



Figure 1: Paper overview

The data for the financial statement analysis can be found in the company's income statement, balance sheets and cash flow statement. These data are easily accessible via the investor relations sections of all publicly traded companies. We will use data from BASF SE's 2011 annual Integrated Report 2011 to illustrate our analysis.²

After studying this Teaching Note, students should be able to perform a horizontal and vertical analysis of financial statements of a company, compute the most important accounting ratios and critically assess and compare the financial performance of an analyzed company.

¹ Standard textbooks in Accounting and Finance are also explaining ratio analysis. See for example Horngren et al. (2011), and Brealy et al (2010).

² See BASF (2012).

2. Horizontal and vertical analysis

A good starting point for the performance appraisal of the company is the income statement. Of particular interest are the sales ("top line") and the net income ("bottom line"). A negative net income indicates that the company has been in trouble and is destroying value. Many decisions hinge on the development of these numbers. Do we need to boost sales or cut costs?

BASF Report 2011

Consolidated statements of income (million €)	2011	2010	Change
Sales	73,497	63,873	15.07%
Cost of sales	(53,986)	(45,310)	19%
Gross profit on sales	19,511	18,563	5%
Selling expenses	(7,323)	(6,700)	9%
General and administrative expenses	(1,315)	(1,138)	16%
Research and development expenses	(1,605)	(1,492)	8%
Other operating income	2,008	1,140	76%
Other operating expenses	(2,690)	(2,612)	3%
Income from operations	8,586	7,761	11%
Other Income, net	984	299	229%
Interest income	189	150	26%
Interest expense	(763)	(773)	-1%
Other financial income	909	866	5%
Other financial expenses	(935)	(930)	1%
Financial result	384	(388)	-199%
Income before taxes and minority interests	8,970	7,373	22%
Income taxes	(2,367)	(2,299)	3%
Income before minority interests	6,603	5,074	30%
Minority interests	(415)	(517)	-20%
Net income	6,188	4,557	36%

Table 1: BASF income statement 2011

However, by looking at one year's numbers alone, we only gain a limited view. Therefore, one often considers the historical percentage change. The study of percentage changes in comparative statements is also called horizontal analysis. It is calculated in two steps, illustrated by the computation of the sales change.

1. The change amount is calculated: € 73,497 (2011) - € 63,878 (2010) = € 9,624 (increase).
2. The change amount in EUR is divided by the amount of the base period (2010): € 9,624 / € 63,873 = 0.1507 ≈ 15 %

Trend percentages are another form of horizontal analysis. How have sales changed over the past years? Derived from the data provided by BASF for the past ten years, we can see that BASF has more than doubled its sales over that period of time.

A "smoothed" growth rate is the compound annual growth rate (CAGR). It shows the average annual growth rate over a period of time. The CAGR is calculated by taking the n^{th} root of the total percentage

growth rate, where n is the number of years in the period being considered, as described in the following formula.

$$CAGR = \left[\frac{\text{Ending value (2011)}}{\text{Beginning value (2002)}} \right]^{\frac{1}{\# \text{ of years}}} - 1$$

BASF	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Sales	32,216	33,361	37,537	42,745	52,610	57,951	62,304	50,693	63,873	73,497
Trend percentage	100%	104%	117%	133%	163%	180%	193%	157%	198%	228%

$$CAGR = [(73,497/32,216)^{0.1}] - 1 = 9\%$$

Figure 2: BASF 10 year sales history

The sales CAGR of BASF over the last ten years was around 9 %. This growth ratio can be compared with other companies and competitors (benchmarking) to see how BASF did in comparison to its peers or companies from other industries.

BASF	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Net income	1,504	910	2,004	3,007	3,215	4,065	2,912	1,410	4,557	6,188
Trend percentage	100%	61%	133%	200%	214%	270%	194%	94%	303%	411%

$$CAGR = [(6,188/1,504)^{0.1}] - 1 = 15\%$$

Figure 3: BASF 10 year net income history

Even more impressive is the net income CAGR being 15 % during the same period. BASF has grown at a high rate and has managed to become even more profitable.

Whereas the horizontal analysis reveals changes over time, the vertical analysis shows the relationship of each item of the statements in percentage to its base. The base of the income statement is sales, while total assets are the base of the balance sheet analysis. To start with the income statement, the formula for each item is calculated as follows:

$$\text{Vertical analysis \%} = \frac{\text{Each income statement item}}{\text{Net sales}}$$

Let us have a look at some key figures from the vertical analysis (see table 2):

- **Cost of sales:** In “classic” accounting terms this line is called cost of goods sold. All direct costs (material and wages) and manufacturing overhead costs are included here (based on the absorption costing logic).
- **Gross profit:** Difference between sales and cost of sales. It indicates how much a business earns from the sales of its products and services to be able to pay for the indirect costs like R&D or general administration costs.

BASF Report 2011

Consolidated statements of income (million €)	2011	% of Sales	2010	% of Sales
Sales	73,497	100%	63,873	100.00%
Cost of sales	(53,986)	73%	(45,310)	70.94%
Gross profit on sales	19,511	27%	18,563	29.06%
Selling expenses	(7,323)	10%	(6,700)	10.49%
General and administrative expenses	(1,315)	2%	(1,138)	1.78%
Research and development expenses	(1,605)	2%	(1,492)	2.34%
Other operating income, net	(682)	-1%	(1472)	2.30%
Income from operations	8,586	12%	7,761	12.15%
Other Income, net	984	1%	299	0.47%
Interest income	189	0%	150	0.23%
Interest expense	(763)	1%	(773)	1.21%
Other financial income, net	(26)	0%	(64)	0.10%
Financial result	384	1%	(388)	0.61%
Income before taxes and minority interests	8,970	12%	7,373	11.54%
Income taxes	(2,367)	3%	(2,299)	3.60%
Income before minority interests	6,603	9%	5,074	7.94%
Minority interests	(415)	1%	(517)	0.81%
Net income	6,188	8%	4,557	7.13%

Table 2: BASF vertical income statement

As we can see in table 2, this figure can also be shown as a % of sales. In this case, this figure is called gross margin. In the case of BASF, we see that in 2011 the gross margin slightly decreased, probably due to higher material (oil based) costs. In general, a large drop in the gross margin is perceived as an alarming signal to investors. Decreasing profitability may lead to lower net income, lower dividend payments and a lower share price. We can see other percentages of special expenses like R&D or interest payments, which seem to be under control at BASF.

The vertical analysis tells us about the business model of a company. A service company has very little cost of sales and a pharmaceutical company has typically a lower percentage of cost of sales but makes up for it by substantially higher sales (marketing) and R&D expenses.

Net income as % of sales is also often referred to as return on sales (RoS). It shows how much the company retains from each € sold. The RoS is alternatively calculated by using the income from operations or EBIT (earnings before interest and taxes). This % is also called the EBIT margin and can be well used for comparing different companies, since it shows the profitability of the business regardless of the financial structure and the applied tax scheme.

To put the numbers in perspective, it is essential to compare them with data of competitors. Comparing BASF with Dow Chemicals (see below), we can see that BASF has almost double the gross margin than Dow and almost double the RoS.

BASF versus DOW CHEMICAL 2011		BASF	DOW CHEMICAL		
		in million €	in million \$		
Consolidated statements of income		2011	% of Sales	2010	% of Sales
Sales		73,497	100%	59,985	100.00%
Cost of sales		(53,986)	73%	51,029	85.07%
Gross profit on sales		19,511	27%	8,956	14.93%
SG&A		(8,638)	12%	(2,788)	-4.65%
Research and development expenses		(1,605)	2%	(1,646)	-2.74%
Other operating income, net		(682)	-1%	(843)	-1.41%
Income from operations		8,586	12%	3,679	6.13%
Other Income, net		984	1%	1223	2.04%
Interest income		189	0%	40	0.07%
Interest expense		(763)	1%	(1341)	-2.24%
Other financial income, net		(26)	0%	0	0.00%
Financial result		384	1%	(78)	-0.13%
Income before taxes and minority interests		8,970	12%	3,601	6.00%
Income taxes		(2,367)	3%	(817)	-1.36%
Income before minority interests		6,603	9%	2,784	4.64%
Minority interests		(415)	1%	(42)	-0.07%
Net income		6,188	8%	2,742	4.57%

Table 3: BASF vs. Dow Chemical income statement 2011³

The statement of the pure percentages is well suited for the comparison of different companies. They are also called common-size statements (see figure 4).

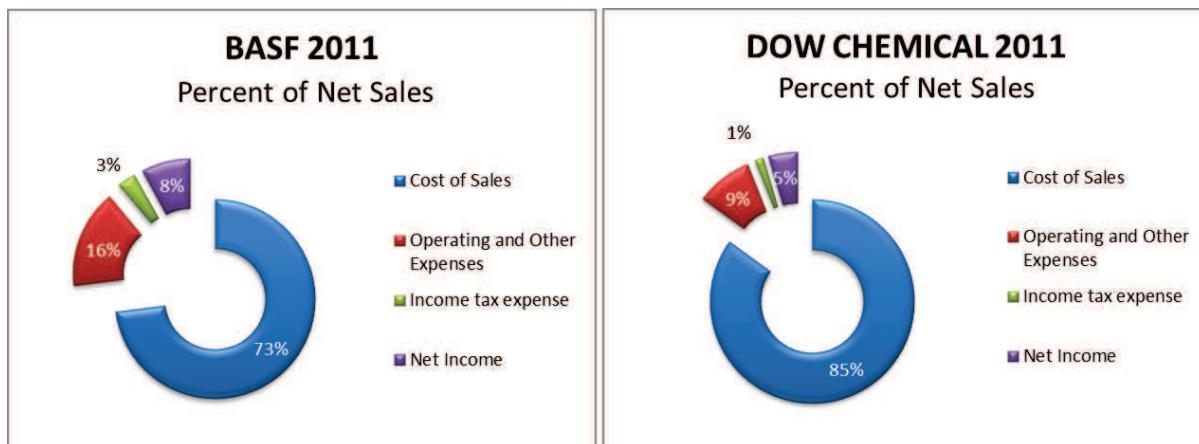


Figure 4: Common size statements BASF vs. Dow Chemical

The vertical analysis of BASF's balance sheet reveals a strong balance sheet with an equity percentage of 41%. A high equity portion and long-term liabilities (32%) signal a very conservative balance sheet approach, well braced for the short-term turmoil of another financial crisis. It is interesting to note, that banks, following a substantially riskier business approach have equity ratios of less than 10%. At this rate, industrial companies would probably not get any loans, run into trouble with their suppliers due to a lack of credit-worthiness and ultimately head for bankruptcy.

³ Dow Chemical's data are also available online. See Dow Chemical (2012), pp. 169-174.

Intangible assets form 19% of total assets at BASF in 2011. Generally speaking, a high percentage of intangible assets such as that of BASF might cause worries, as they could be considered to be "worthless" or at least difficult to transform into cash. At BASF, these assets could be patents (due to research) or goodwill (due to acquisitions). Investors would probably have a closer look at these positions.

The high and growing percentage (44%) of short term assets, mainly inventories (16%) and accounts receivables (16%) might be a reason for operational concern and a lever for optimizing the supply chain. However, we need more operational insight to understand the reasons behind the figures.

BASF Report 2011 (Simplified)

Assets (million €)

	December 31, 2011	% of Total	December 31, 2010	% of Total
Intangible assets	11,919	19%	12,245	21%
Property, plant and equipment	17,966	29%	17,241	29%
Other long term assets	4,202	7%	5,046	8%
Long-term assets	34,087	56%	34,532	58%
Inventories	10,059	16%	8,688	15%
Accounts receivable, trade	10,886	18%	10,167	17%
Other short term assets	4,095	7%	4,513	8%
Cash and cash equivalents	2,048	3%	1,493	3%
Short-term assets	27,088	44%	24,861	42%
Total assets	61,175	100%	59,393	100%

Equity and liabilities (million €)

	December 31, 2011	% of Total	December 31, 2010	% of Total
Equity of shareholders of BASF	24,139	39%	21,404	36%
Minority interests	1,246	2%	1,253	2%
Equity	25,385	41%	22,657	38%
Long-term liabilities	19,313	32%	21,168	36%
Accounts payable, trade	5,121	8%	4,738	8%
Other Short-term liabilities	11,356	19%	10,830	18%
Short-term liabilities	16,477	27%	15,568	26%
Total equity and liabilities	61,175	100%	59,393	100%

Table 4: BASF vertical balance sheet 2011

To put the balance sheet data into perspective, it is often helpful to compare them with a main competitor. In this case the benchmarking with Dow Chemical is quite interesting.⁴ We immediately recognize the substantially higher share of intangible assets and the higher amount of long-term liabilities at the expense of equity.

4 See Dow Chemical (2012) for the data.

Benchmarking BASF Report 2011 vs. Dow Chemical

Assets	BASF		DOW CHEMICAL	
	in million €		in million \$	
	December 31, 2011	% of Total	December 31, 2011	% of Total
Intangible assets	11,919	19%	21,446	31%
Property, plant and equipment	17,966	29%	17,299	25%
Other long term assets	4,202	7%	7,057	10%
Long-term assets	34,087	56%	45,802	66%
Inventories	10,059	16%	7,577	11%
Accounts receivable, trade	10,886	18%	4,900	7%
Other short term assets	4,095	7%	5,501	8%
Cash and cash equivalents	2,048	3%	5,444	8%
Short-term assets	27,088	44%	23,422	34%
Total assets	61,175	100%	69,224	100%
Equity and liabilities				
Equity of shareholders	24,139	39%	22,281	32%
Minority interests	1,246	2%	1,010	1%
Equity	25,385	41%	23,291	34%
Long-term liabilities	19,313	32%	32,299	47%
Accounts payable, trade	5,121	8%	4,778	7%
Other Short-term liabilities	11,356	19%	8,856	13%
Short-term liabilities	16,477	27%	13,634	20%
Total equity and liabilities	61,175	100%	69,244	100%

Table 5: BASF vs. Dow Chemical balance sheet

In order to complement the first glance analysis of BASF, we look at the consolidated statement of cash flows. “Profit is opinion, cash is fact.” goes the saying amongst investors. Therefore, they carefully analyze the cash flow statement and in particular the line of the cash provided by operating activities (operating cash flow) and the net changes in cash. Is the company producing a decent stream of cash to invest, pay its debts and shareholders and to build up a cash pile for future needs? BASF generated 7.1 billion euro as operating cash flow in 2011, which was used for the above mentioned purposes. It is obvious that BASF is in a healthy cash generating position. Negative operating cash flows are reason for panic amongst investors. The respective company is “burning” cash, which will eventually lead to bankruptcy even if the company looks still profitable.⁵

5 See Alireza et al (2012) for the prediction power of financial ratios to predict financial crises of companies.

BASF Report 2011

Consolidated statements of cash flows (million €)

	2011	2010
Net income	6,188	4,557
Depreciation and amortization of intangible assets, property, plant and equipment	3,419	3,393
Changes in inventories	(1,239)	(1,341)
Changes in receivables	(45)	(1,839)
Changes in operating liabilities and other provisions	378	1,500
Changes in pension provisions, defined benefit assets and other non-cash items	(68)	273
Net gains from disposal of long-term assets and securities	(1,528)	(83)
Cash provided by operating activities	7,105	6,460
Payments related to intangible assets and property, plant and equipment	(3,410)	(2,548)
Payments related to financial assets and securities	(346)	(480)
Payments related to acquisitions	(148)	(605)
Proceeds from divestitures	665	43
Proceeds from the disposal of long-term assets and securities	1,501	874
Cash used in investing activities	(1,738)	(2,716)
Capital increases/repayments and other equity transactions	32	(18)
Proceeds from the addition of financial liabilities	2,306	3,679
Repayment of financial liabilities	(4,678)	(5,974)
Dividends paid		
To shareholders of BASF SE	(2,021)	(1,561)
To minority shareholders	(457)	(370)
Cash used in financing activities	(4,818)	(4,244)
Net changes in cash and cash equivalents	549	(500)
Effects on cash and cash equivalents		
From foreign exchange rates	9	86
From changes in scope of consolidation	(3)	72
Cash and cash equivalents at the beginning of the year	1,493	1,835
Cash and cash equivalents at the end of the year	2,048	1,493

Table 6: BASF cash flow statement 2011

3. Using ratios to make decisions

The internet has created unmatched transparency about financial data of corporations. It has become very easy to compare accounting ratios as mentioned above. Out of the plethora of key ratios each company and investor chooses a certain set to display the performance of a company. In the following chapter we will discuss the most commonly used financial ratios measuring:

1. the ability to pay back long-term and short-term liabilities (and avoid insolvency/bankruptcy),
2. the ability to sell inventory and collect receivables (efficiency ratios),
3. the profitability and investment opportunity of a company.

The transparency of performance is valuable for analysis. The more important question, however, is: What can we do to influence ratios into a desired direction?

3.1. Measuring the ability to pay back debt

Most companies have long-term debt (bank or bond loans) which is not due within the time frame of one year. Additionally, we will typically find short-term liabilities (former long-term liabilities that are close to maturity date), and trade payables, the company owe to its suppliers. In order to assess the creditworthiness of a company, from the perspective of a potential supplier, bond investor or bank, it is recommended to analyze ratios giving hints about the ability of a company to pay back its debt.

The first and most intuitive ratio is the *debt ratio*. Which percentage of total assets is financed by debt? Or to use the definition of the equity ratio: Which percentage of total assets is financed by equity which will pay for potential losses and guarantee for the repayment of outstanding loans?

The debt ratio for BASF in 2011 is easy to calculate:

$$\text{Debt ratio} = \frac{\text{Total liabilities}}{\text{Total assets}} = \frac{19,313 \text{ (long)} + 16,477 \text{ (short)}}{61,175} = 59\%$$

A debt ratio of less than 60% is not high. Dow Chemical had a debt ratio of 66%. The German small and middle-sized enterprises (SMEs) are notorious for having a relatively high debt ratio of more than 75%. Banks often have a debt ratio of more than 90%. The quantity of debt used to finance a firm's assets is also called the leverage. A firm with considerably more debt than equity is considered to be highly leveraged. Although the leverage effect might have positive connotations in finance: Higher debt leads to higher interest payments and a lower credit worthiness of a company. What can be done to decrease the debt ratio, or to deleverage? The most obvious and intuitive measure is to raise equity. However, this is the politically and economically most difficult approach. A change in the dividend policy might eventually lead to higher retained earnings and thus slowly increases equity. Thus, the equity story remains a difficult one. If equity remains stable, the only possible way to bring down the debt ratio is by selling assets and paying debts. This could be assets not relevant for the operational business like unused property or financial investments. This would be an easy move, depending on the salability of the assets. Operational assets could be sold and leased back – this practice may include selling company trucks, properties, machines and even office material like computers and copy machines. As a short term measure, this could be rather costly, because it might be difficult to attain selling prices at book value. One should also take into consideration that the leasing of operational assets will burden the operational income.

The debt ratio is a good first indicator, but it does not specifically evaluate the ability to pay interest expense. Analysts use the *times-interest-earned ratio* to measure the number of times the operating income can cover the interest expense. Therefore, this ratio is also called the *interest-coverage ratio*. The computation for BASF in 2011 works as follows:

$$\text{Times} - \text{interest} - \text{earned ratio} = \frac{\text{Income from operations}}{\text{Interest expense}} = \frac{8,586}{763} = 11.3$$

This is a very conservative position. BASF SE could pay its interest more than 11 times with its current income from operations. The long-term norm for U.S. business is in the range of 2.0 to 3.0. Dow Chemical displays an interest-coverage of 2.7. In order to improve the times-interest-earned ratio, first, the level of debt has to be reduced by deleveraging. Second, it might be worthwhile to investigate refinancing alternatives (e.g. bonds), which offer lower interest rates.

If we concentrate on short-term liabilities, a new term comes into play: *working capital*. It is quickly defined as current assets minus current liabilities, measuring the ability to pay short-term liability with short term assets. To make informed decisions based on working capital conditions, management accountants, analysts and investors create ratios. The most frequently used ratio is the *current ratio*. It simply divides a company's current assets by its current liabilities. In the case of BASF 2011, we get the following:

$$\text{Current ratio} = \frac{\text{Current assets}}{\text{Current liabilities}} = \frac{27,088}{16,477} = 1.64$$

A strong current ratio can be taken as an indicator for a strong financial position, meaning that the company has sufficient liquid assets to run its operational business. An acceptable level for the current ratio depends on the industry: Dow Chemical has a current ratio of 1.71 in 2011. In most industries anything around 1.5 could be seen as the norm, while a current ratio of 2.0 is considered to be very strong. What has to be done to increase the current ratio? One option is to take a long term loan to finance the operational business. The new cash injection would per se increase current assets. The other possibility is to transform current liabilities (bank loans) into long-term loans.

The *acid-test ratio* (or *quick ratio*) answers the hypothetical question whether a company would be able to pay all its current liabilities if they were due immediately. Since this is considered to be a very tough stress-test, it has been poetically called acid-test. To compute the acid-test ratio, one has to add cash, short-term investments and net receivables (these are all items that can be quickly transferred into cash. Note that inventory is not part of this list.) and divide the sum by current liabilities. In the case of BASF, it looks as follows:

$$\text{Acid} - \text{test ratio} = \frac{\text{Cash} + \text{short term investments} + \text{net current receivables}}{\text{Current liabilities}}$$

$$\text{Acid} - \text{test ratio} = \frac{2,048 + 4,095 + 10,886}{16,477} = 1.03$$

An acid-test ratio of 0.9 to 1.0 is acceptable in most manufacturing industries. Retailers have a considerably lower quick ratio due to their high inventory. Dow Chemical had a quick ratio of 1.2 in 2011. The difference can be found in the relatively large inventory of BASF. Inventory management is also the key for increasing the acid-test ratio. Reducing inventory (e.g. end of year sales) and using less buffer inventory can enhance the acid-test ratio.

3.2. Measuring working capital efficiency

This leads us to more operational working capital ratios measuring the ability to sell inventory and collect receivables.

Inventory turnover measures how many times a company sells its average inventory during one fiscal year. A high turnover indicates an ease to sell products, whereas a low turnover could be interpreted as problematic.

To calculate inventory turnover, we divide cost of goods sold (or cost of sales) by the average inventory. Why do we use cost of sales/ goods sold instead of the sales number? It is because sales include the price premium to arrive at the selling price. In order to get to the turnover, the inventory has to be evaluated at cost and not at selling price.

Let's take the BASF example for 2011:

$$\text{Inventory turnover} = \frac{\text{Cost of sales}}{\text{Average inventory}} = \frac{53,986}{(10,059 + 8,688)/2} = 5.76$$

The evaluation of this figure depends on the comparison with other companies. Inventory turnover varies from industry to industry, with low turnover industries like manufacturing tending to have an inventory turnover of 3, whereas high turnover industries like natural gas suppliers have a substantially higher inventory turnover of over 30. Dow Chemical had an inventory turnover of 6.96 in 2011. Being significantly higher, it is an indicator for working capital efficiency. This corresponds to a build of BASF inventory of 16 % in 2011, whereas BASF showed only a 15 % increase in sales. Dow Chemical increased sales in 2011 by 12 % and increased its inventory by only 7 %. It would be premature to jump to the conclusion that BASF had a sloppy inventory management in 2011, but the development might merit further scrutiny.

What can be done to increase inventory turnover? Logically it can be enhanced by selling more without using more average inventory (and thus eventually running the risk of a stock-out). But it might also depend on old, unsalable inventory, which could be identified over an aging report by ERP-systems for instant. ERP-systems identify old inventory items and slow sellers. Scrapping low sellers from the product offering might be an option to increase inventory turnover. The partly or full

depreciation of items in inventory that are older than a year or two years will also have an (accounting) effect on inventory turnover.

The other important ingredient of working capital is receivables. By allowing our customers to buy and pay later we provide a financial service. The ability to collect the outstanding receivables is a key success factor. Days of sales outstanding (DSO), or days' sales in receivables, is a popular ratio to measure the ability to collect receivables. To compute the ratio we follow two steps: First, dividing net sales of a company by 365 days in order to one average day's sales. Second, we divide the average net accounts receivables by one day's sales. In the case of BASF in 2011, we get the following picture:

$$\text{DSO} = \frac{\text{Average net receivable}}{\text{One day's sales}} = \frac{10,886 + 10,167/2}{73,497/365} = \frac{10,527}{201} = 52$$

52 is a relatively high number stating that the average invoice gets paid within 52 days which is almost two months. BASF thus finances its customers to a large extent. Dow Chemical had DOS of 29 which is considerably lower. Of course, it might be relatively easy to reduce the payment terms to 30 days. However, BASF might lose some customers in this process and eventually accept lower prices for its products. In small companies the installation of an effective receivables management (which starts with a creditworthiness check before engaging in a credit sales contract, monitors all receivables with an aging report and includes an effective dunning system) might be advisable to control this area of working capital. Big corporations have embedded this into their business processes. One option might be *factoring*, where companies sell on their invoices to a third party debt collection agency, which in turn collects the sales invoices on behalf of the company. In this case all receivables are sold to a factoring company (usually a bank) at a certain discount. The factoring agency takes care of the receivables management as well as credit risks and pays cash to the issuing company immediately. Many companies use factoring to improve cash flow. However, it also releases the administrative burden of managing a sales ledger department.

3.3. Measuring profitability

Addressing the profitability topic, or the bottom line analysis of a company, we put net income or operational earnings in proportion to sales, assets or equity. Again, there are many different ways to do it and we are forced to restrain ourselves to the most basic ratios. We have already discussed some of the ratios analyzing the vertical income statement.

Return on sales (RoS) is computed as net income divided by net sales. For BASF we get the following:

$$RoS = \frac{\text{Net income } 6,188}{\text{Net sales } 73,497} = 8.4 \%$$

Dow Chemical achieved a RoS of 4.6 % in 2011, which is substantially below BASF, meaning BASF earned, after taxes, more money on each € of sales. To answer the question how profitable BASF made use of its assets, we compute the *return on assets* ratio. To do this we add the interest expense to net income and divide the sum by the average of total assets. Why do we add interest expenses? Interest expenses were paid for using a part of the assets. To get to the real return on assets, we have to add this payment to get the return regardless of the financing of the capital.⁶ For BASF this looks like this:

$$RoA = \frac{\text{Net income} + \text{interest expense}}{\text{Average total assets}} = \frac{6188 + 763}{(61,175 + 59,393)/2} = 11.5\%$$

BASF earned on its assets 11.5 % after tax. The same figure is 5.9 % for Dow Chemical. Again, BASF seems to be more profitable in relation to its capital use.

Investors are the owners of equity. They have a particular interest in the ratio *return on equity (RoE)*. What is the return on their investment? Minority Investors might receive preferred dividends that diminish the return to shareholders. The *RoE* is therefore defined and computed like this for BASF 2011:

$$RoE = \frac{\text{Net income} *}{\text{Average common stockholder's equity}} = \frac{6,188}{(24,139 + 22,281)/2} = 27 \%$$

* Net income without preferred dividends or minority interests.

Dow Chemical has a RoE of 15.2 % in 2011. A *return on equity* of 15 to 20 % is considered to be respectable in most industries. BASF proves to be more profitable.

What helps to increase the profitability? The simple answer is reduce costs and increase prices. However, it seems rather difficult to increase prices without new and innovative products, while cutting costs in marketing, purchasing, personnel and R&D is rather painful leading to possible negative long-term consequences. Profitability is a lagging indicator for the overall economic vitality of a company, depending on its strategy, its products, reputation, execution and personnel performance, to name a few factors.

The number of financial ratios is long. Open online resources like Bloomberg Business Week provide free access to many ratios for almost all publicly listed companies. All board and investor

⁶ A minor flaw in this equation is that the interest expenses also have a tax shield function, which is neglected. The interest expenses decrease the taxable income and overall income taxes.

presentations usually include an overview of key financial ratios. In many instances companies use industry specific ratios or even company specific ratios. The presented 9 ratios are a limited but representative selection of financial ratios with a focus on management accountants. Left out are investor related ratios like price-earnings ratio or Total Shareholder Return. Investors take into account all of these data and the companies' business outlooks to determine share prices. To assess the performance of a company, we should not neglect to risk a glance at the share price development over the last years.

Comparison of share price development between BASF and Dow Chemical:

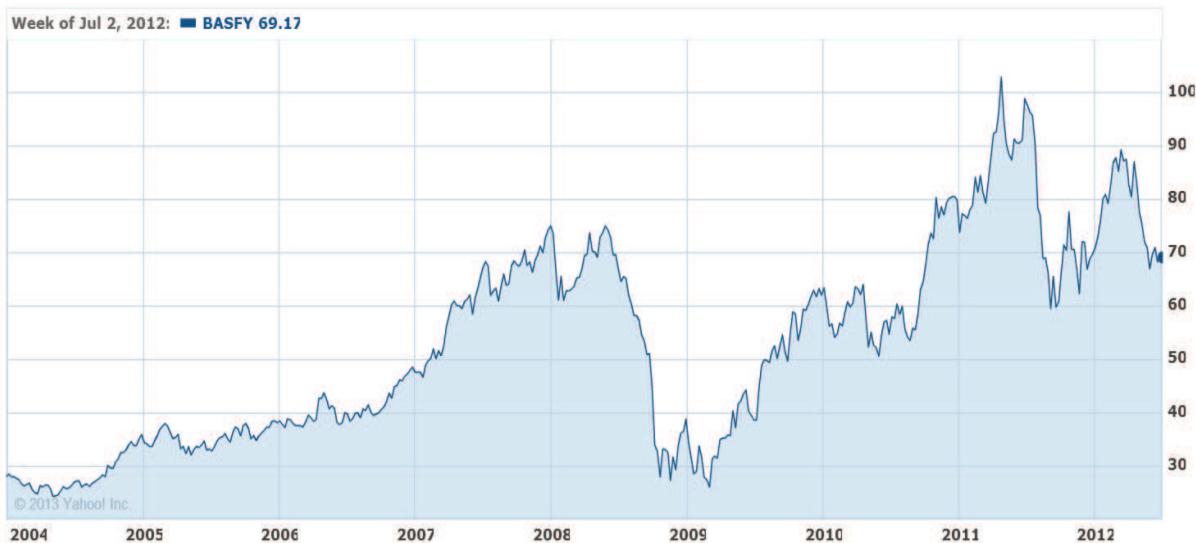


Figure 5: BASF share price history (Source: <http://finance.yahoo.com>)

BASF SE more than doubled its share price from 2004 to July 2012. Investors were obviously happy with the long-term performance of BASF.



Figure 6: Dow Chemical share price history (Source: <http://finance.yahoo.com>)

Dow Chemical could not maintain its share price from 2004 and traded in July 2012 more than a third below its level of 2005. There are many other factors influencing investors than we could analyze above, but the development does not contradict our findings that BASF indeed is a profitable company providing decent returns for its shareholders. Please find below an overview of the most important financial/accounting ratios treated in this teaching note:

Current ratio	Ability to pay short term liabilities with current assets	Current assets Current liabilities
Acid test/ Quick ratio	Ability to immediately pay current liabilities	Cash + short term investments + net current receivables Current liabilities
Debt ratio	Ability to pay long-term debt	Total liabilities Total assets
Times interest earned	Ability to pay interest expenses	Income from operations Interest expense
Inventory turnover	The salability of inventory	Cost of goods sold Average inventory
Days's sales outstanding DSO	Days it takes to collect receivables.	Average net accounts receivable One day's sales
Return on sales RoS	The net income per € of revenues/ sales	Net income Net sales
Return on assets RoA	The profit of the used assets/capital	Net income + interest expense Average total assets
Return on equity RoE	The income per € of shareholders' equity	Net income Average common stockholders'equity

Table 7: Important accounting ratios

4. Warning signals in financial statements

Accounting scandals like Enron, Worldcom or Parmalat have shaken the trust of many investors in the financial statements of companies.⁷ Although the financial statements are audited by third parties (for big and international corporations this is done by the big four: KPMG, E&Y, PwC or Deloitte), the skeptical analyst might follow a different approach towards analyzing financial statements searching for warning signals by asking the following five questions:

- **Does the company have an earnings problem?** Has the profitability decreased and has the company even experienced an operational or net income loss? If this goes together with a high debt ratio, the company under investigation might not be able to sustain this situation for long.

⁷ See Lundstrom (2009) for a perspective on financial statement fraud.

- **Does the cash flow match the income?** Is the cash flow from operations lower than net income? Does the company refinance itself by selling plant assets? The cash validates the earnings (remember: "Profit is opinion - cash is fact."). Signals for cash shortage might foreshadow insolvency.
- **Does the company build up inventories?** An easy way to overstate net income is by overstating ending inventories. The question is whether the inventory is salable at the minimum price of cost of goods manufactured, in which production overhead is included. A decreasing inventory turnover might exacerbate this picture.
- **Do the different operational driven movements in the financial statement fit together?** Sales, inventory and receivables should be fairly correlated in their movement. Higher sales trigger higher inventory levels and more receivables. Opposing movements should stir attention.
- **Does the company build up high levels of receivables, it might not be able to collect?** Although there might be legitimate operational reasons for not being able to collect receivables, the skeptical mind might ask whether the related sales could lead to an inevitable shortage in cash. A criminal overstatement of fictitious sales might lead to receivables that never materialize.

External analysts are confronted with substantial information asymmetry. If trust is compromised and cannot be restored by management, it might be wise not to invest into or do business with a company that sends out warning signals or red flags.

5. Limitations of financial ratio analysis and further sources of information

Financial ratio analysis helps the analyst to get a first understanding of a company. However, it remains a very theoretical and past-oriented approach without a deeper understanding of the business model of a company, the comprehension of the dynamics of the industry and the markets the company is serving. To serve this information need the annual reports of companies include also non-financial data in the form of special reporting sections: These are the President's Letter to Shareholders, the Management Discussion and Analysis and the Auditor's Report.

The *President's Letter to the Shareholders* gives a personal statement about the state of the company and informs investors about major changes and strategic directions.

The *Management Discussion and Analysis* section displays management's explanations why the financial data developed like they did and provide plans for future developments and strategic projects. These explanations and forward-looking statements help external analysts to understand and evaluate financial data. BASF included many non-financial data about its ecological and social performance of 2011 in this section. This increases the pieces of the jigsaw that have to fit together to create a harmonious investor story.

The *Auditor's Report* expresses the view of the external auditors as opposed to the insider view dominating the annual report and the above mentioned sources. In the case of the BASF 2011 report, the external auditors come after their audits to the following conclusions (see page 141): "... the Consolidated Financial Statements comply with IFRS...and give a true and fair view of the net asset, financial position and results...The Management's Analysis is consistent with the Consolidated Financial Statements and as a whole provides a suitable view of the Group's position and suitably presents the opportunities and risks of future development." This sounds reassuring.

In order to assess the performance of a company, the financial ratio analysis is a fundamental starting point. To complement the performance picture, non-financial indicators and assessments about markets, competitors and internal strategies and processes are presented in the annual report. As an insider, one could bundle all these data in the form of a balanced scorecard in order to achieve a more holistic overview and actively manage the overall performance of a company.⁸

⁸ See Cardinaels and van Veen-Dirks (2010) on the effects on displaying financial and non-financial data in the form of a balanced scorecard.

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