TALLINN UNIVERSITY OF TECHNOLOGY

School of Business and Governance

Department of Business Administration

Arttu Sebastian Viippola

COMPARATIVE FINANCIAL STATEMENT ANALYSIS OF CAR MANUFACTURING COMPANIES BASED ON VOLKSWAGEN GROUP AND BMW GROUP DURING YEARS 2012–2016

Bachelor's thesis

International Business Administration, Finance and Accounting

Supervisor: Paavo Siimann, MSc

Tallinn 2017

I declare I have compiled the paper independently and all works, important standpoints and data by other authors have been properly referenced and the same paper has not been previously presented for grading. The document length is 14,559 words from the introduction to the end of summary.

Arttu Sebastian Viippola ……

(signature, date)

Student's code: 156079TVTB

Student's e-mail address: viippolaarttu@gmail.com

Supervisor: Paavo Siimann, MSc

The paper conforms to the requirements in force

.....

(signature, date)

TABLE OF CONTENTS

ABSTRACT

The automotive industry has developed significantly over the past decades as, by 2016, the level of car production has nine-folded since 1950, and the number of cars sold has doubled since 1990. Yet the industry continues to grow due to new technology advantages and improvements, as well as higher management skills. In September 2015, Volkswagen got caught cheating on emission tests by installing a software in their cars that could momentarily reduce the actual emissions while the cars were tested.

The consequences have affected their financial performance, and hence, the aim of this thesis is to show the effects of the emission scandal to Volkswagen's financial statements, compare the differences to BMW's performance during the studied period of 2012–2016, and propose recommendation that would their efficiency in a continuously developing environment.

The empirical part of this thesis was carried out, by using comparative financial statement analysis, to find differences in the companies' asset and capital structures, growth, asset and labour usage efficiency, liquidity, profitability, profit per employee and relative intensity. In general, it was founded that, BMW was more profitable mostly due to more efficient management of cash conversion cycle, as well as higher operating profit per employee, return on sales and labour productivity. They also had more favourable and sustainable asset and capital structure, compared to Volkswagen.

Keywords: automotive industry, comparative financial statement analysis, matrix analysis.

INTRODUCTION

The automotive industry has experienced significant improvements as the demand and production has increased rapidly over the past decades. According to International Organization of Motor Vehicle Manufacturers (OICA), the global passenger car sales have increased by 38.0% by 2016 since the financial crisis in 2009, from 50 million to 69 million cars. According to OICA, by 2016, the level of car production has nine-folded since 1950, and the number of cars sold have doubled since 1990. Yet the industry continues to grow due to new technology advantages and improved management skills. According to McKinsley's global automotive industry analysis, companies are facing many difficulties and challenges arising from these technology developments, as well as continuously shifting sales and tightening environmental regulations. Hence, they must adjust their strategic priorities, as well as make appropriate investments and resource acquirements to benefit from these challenges.

However, the study took place between 2012 and 2016. Some of the big players in the automotive industry, including Volkswagen, got caught cheating on emission tests in September 2015, by installing a software in their cars that could momentarily reduce the actual emissions while the cars were tested. This resulted in the resignation of Volkswagen's CEO Martin Winterkom, and the extent of the fines is still under determination and investigation. BMW Group didn't play any role in the emission scandal, and thus, makes it worthy to compare the financial performance between these two companies.

Actuality of this study is supported by the constant growth and development of the automotive industry, as well as the continuously increasing demand. The emission scandal also provides an excellent opportunity to investigate the true impacts to a company's profitability and efficiency.

Aim of this study is to show the effects of the emission scandal to Volkswagen's financial statements and, compare the differences to BMW's performance during the studied period.

Objective of this study is the Volkswagen Group and BMW Group, which are German based globally operating companies. The study of the companies' annual reports on a time period of five years will illustrate the dynamics and structure of their capital and assets before, during and after the emission scandal. The three research questions are:

- How does the Volkswagen's and BMW's capital and asset structures differ from each other during the studied period?
- Which company is more efficient and why in terms of asset and labour force usage, liquidity, profitability, and is growing faster?
- Which company has higher profit per employee, and which components had the biggest impact on that?
- Which company has been more efficient in terms of relative intensity?

Methodology used in this study is comparative financial statement analysis. The analysis will reflect the asset and labour force usage efficiency, profitability, and growth based on the annual reports from 2012 to 2016. Accordingly, the benchmarking will provide comparative results. The author uses vertical, horizontal, trend, ratio matrix and component analysis for both companies as the approaches.

This study begins by providing an overview of the global automotive industry and market, recent studies with similar methodology, and facts of the companies as well as their position in the market. The second part starts with a comparison of accounting methods and their impact to financial analysis to show that there are no significant differences between the companies. Furthermore, the second part covers the empirical research, following with results from the analysis of the companies' financial performance, structure, growth, solvency, asset and labour force usage efficiency, profit per employee and relative intensity. Finally, all analysis will be concluded and proposals are provided for the companies.

The author would like to thank especially Paavo Siimann for professional advices and guidance, as well as valuable feedback and comments, that have motivated and helped the author to conduct a better graduation thesis. The author would also like to thank fellow students Jesper Hietanen and Anton Savolainen, as well as his own family for motivating and helping during writing the graduation thesis.

1. OVERVIEW OF THE AUTOMOTIVE INDUSTRY

Volkswagen and BMW are both operating in the automotive industry, which is considered to be highly asset and labour intensive, as well as the driving force of the global economy. The industry includes companies that design, manufacture, develop and sell passenger cars. According to OICA, passenger cars are defined as motor vehicles that are used for transporting passengers, and includes at least four wheels and no more than eight seats. The industry generated over 1,500 billion U.S. dollar profits by only the ten leading automotive manufacturers in 2016, according to Statista. Thus, it is needless to say that the economic downturn has had a negative impact on the industry in many ways, especially in 2007–2009. The figure 1 illustrates the proportion of China's, Europe's and the United State's production of passenger cars to the total level of production.

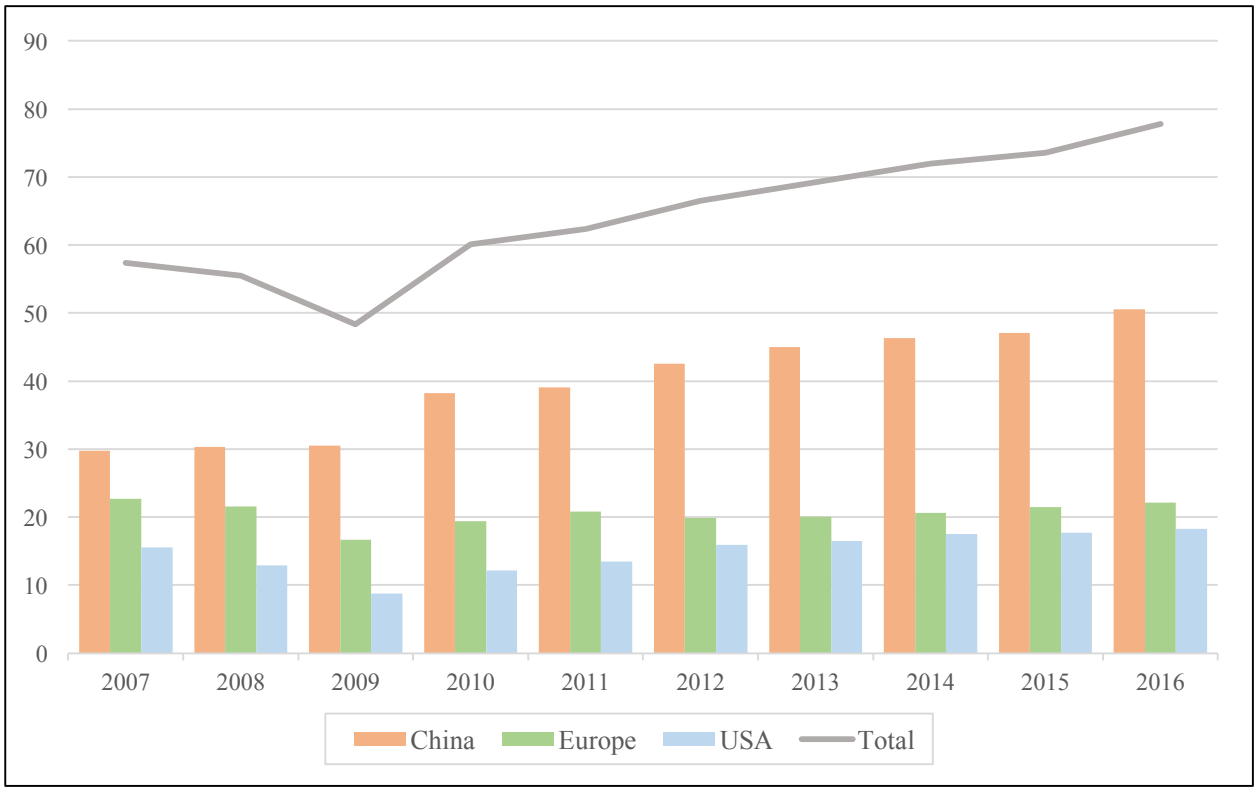

Figure 1. The proportion of China's, Europe's and the United States' production of the total level of passenger car production from 2007 to 2016 (in millions of units)
Source: Compiled by the author's calculations and prepared by the author on the basis of data provided by European Automobile Manufacturers Association (ACEA).

As can be seen from figure 1, the level of total passenger car production fell nearly 16% during the financial crisis totalling to only 48.3 million in 2009. However, the industry has recovered

steadily and is projected to grow even further every year. Mainly due to increased demand the level of production has already grown by 53% since the crisis, as the total production of passenger cars in the world totalled to 77.8 million in 2016. While the US and Europe were struggling during and after the economic crisis, China's production has grown roughly 66% by 2016, totalling to approximately 50.6 million units. By fuelling its economy heavily with debts, the production of China alone accounts to 65.0% of the total production of passenger cars in 2016.

As the demand contracted sharply and people started to avoid replacing their old cars, it led to ballooned inventories of unsold cars while people tried to save money by buying only second-hand vehicles. Another reason for economic slowdown regarding the car sales was the lack of credit availability in Europe and North America which drove the sales down. People lost their jobs and couldn't get a loan from the banks to cover any expensive acquisitions. Thus, governments have been trying to accelerate the recovery from economic slow down by developing different incentives to support the industry and to increment sales. The US government for example, created a program called "Cash for Clunker". This incentive gave car owners an option to trade in their less fuel-efficient cars in exchange to buy more fuel-efficient vehicles by giving credit to qualified people, depending on the vehicle they want to buy. Accordingly, the German government invented a financial incentive which allowed people to switch their old cars to less consuming and modern vehicles. The Brazilian and Chinese Government, on the other hand, made tax reduces on small cars which boosted the sales and reduced excess inventories.

1.1. Overview of the companies

The first company of this research is a German brand, Volkswagen Group. The Group includes twelve brands from seven European countries: Volkswagen Passenger Cars, Audi, Seat, Škoda, Bentley, Bugatti, Lamborghini, Porsche, Ducati, Volkswagen Commercial Vehicles, Scania and MAN. In addition to automotive side, Volkswagen is active in other fields, such as dealer and customer financing, leasing, banking and insurance activities, and fleet management. Volkswagen has 120 production plants in 20 European countries and another 11 countries in the America, Asia and Africa. It has approximately 625,000 workers around the world, and sells vehicles in 153 countries.

For comparison to Volkswagen the author has chosen another German brand, BMW Group. The group employs approximately 125,000 people and acts as the only automobile and motorcycle manufacturer worldwide to focus all its brands on the premium segment, according to their website. VW Group, on the other hand, has a variety of car models in different price categories. With its three brands BMW, MINI and Rolls-Royce, the BMW Group is the world's leading premium manufacturer of automobiles and motorcycles, and also provides premium financial and mobility services. As a global company, the BMW Group has 31 production and assembly facilities operating in 14 countries, and has a global sales network in more than 140 countries.

Table 1. General information of Volkswagen and BMW in 2016

Company name	Year of establishment	Number of employees	Net sales (in millions of euros)	Sales volume (in millions of units)	Net profit (in millions of euros)	Market capitalization (in billions of euros)
Volkswagen	1937	619,346	217.3	10.4	5.4	67.9
BMW	1916	124,729	94.2	2.4	6.9	57.0

Source: Compiled by the author from Volkswagen's and BMW's websites.

As can be see from table 1, it can be concluded that Volkswagen is larger than BMW in terms of number of employees, sales revenue and market capitalization. They also sold over four times more cars in 2016 than BMW. However, BMW's net profit is nearly three times higher, and their net sales per employee is approximately €750,000 whereas Volkswagen's is over twice less. According to the Volkswagen's annual report, their market capitalization has decreased by €18.6 billion from 2014 to 2016 as the share price dropped almost 61% during 2015 due to the emission scandal. BMW, respectively, reached its highest share price of €122.6 during 2015 with a market capitalisation of €63.0 billion, according to their annual report.

As mentioned before, Volkswagen and BMW are both German based company and thus, it is relevant to show their position in the European automotive market. The figure 2 represents the 10 leading car manufacturers, and their shares of the market.

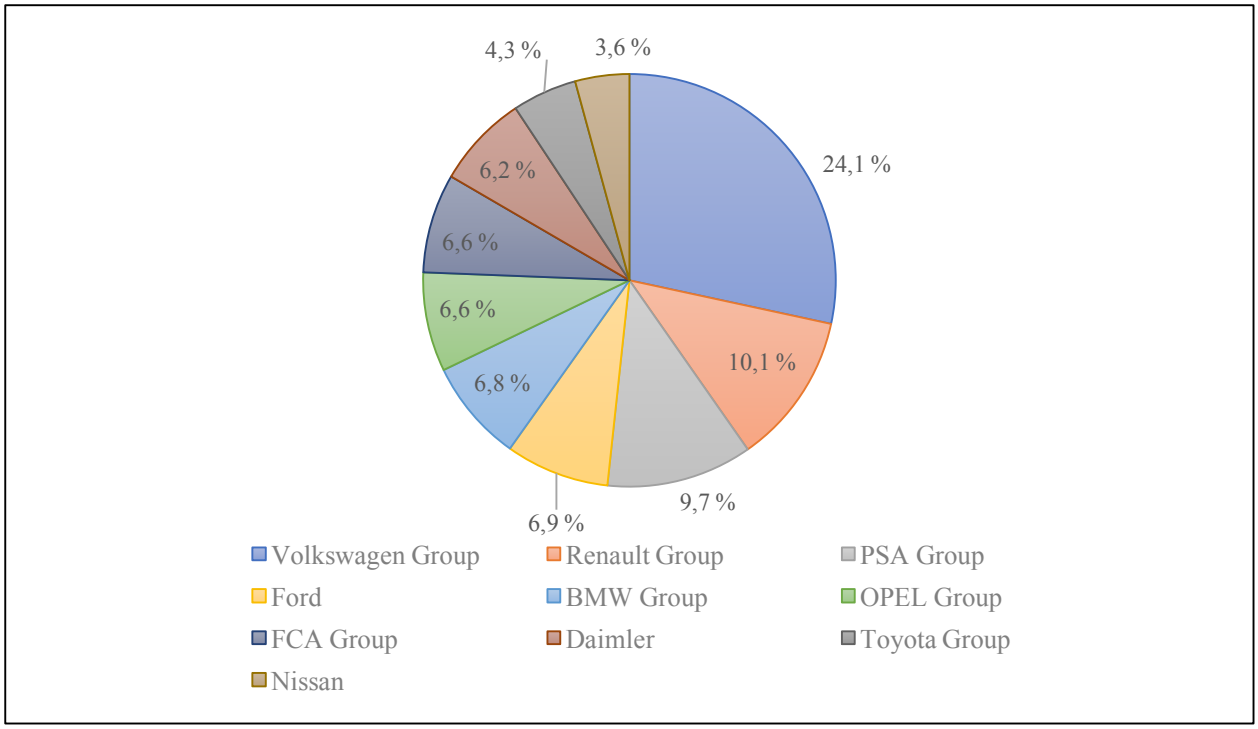

Figure 2. Ten largest car manufacturers in Europe (% of market share)
Source: Compiled by the author's calculations and prepared by the author based on data provided by Statista.

It can be concluded from figure 2, that Volkswagen controls nearly a quarter of the European car market while BMW holds the fourth place with a share of 6.8% of the market. Volkswagen also acts as one of the world's leading manufacturers of automobiles and commercial vehicles. BMW, in turn, is the world's leading manufacturer of premium automobiles and motorcycles, and provider of premium financial and mobility services, as mentioned before.

1.2. Overview of recent studies

The aim of this subchapter is to get a sense of how manufacturing industries and other industries can be analyzed through financial statements and various ratios, and furthermore, by comparing and benchmarking companies within the same industry.

Szucs (2015) in his research "The financial analysis of the Hungarian automotive industry based on profitability and capital structure ratios", explored the structure of the Hungarian automotive

sector and analysed ratios describing the economy. Szucs found that the sector was driven mostly by a narrow group of foreign companies and the capital structures were not varying regarding to the size of the company. Szucs also realized that the Hungarian vehicle industry was mainly foreign dominant due to the exploit of cheap labor costs, tax reliefs and capital withdrawals of those major companies. Szucs sees that the Government's support and prioritized attention is the only way to conduct the sector towards traditional domestic vehicle production and back to the business cycle. Furthermore, Szucs used factor and cluster analysis to make different groups within the indicators to find connections between capital structure and profitability. The study, however, confirmed the previous results and didn't discover any variation in the role of liabilities with respect to profitability, or any models with different capital structures (Szucks 2015, 62-70).

The companies formed three clusters based on their profitability, short-term liquidity and export ratios, as well as the size of the company in terms of net sales and foreign capital. The profitability of the smallest group stood out from the industry average and other groups but didn't have any significant impact due to concentrated labour force and turnover towards top companies. Companies with high profitability, in turn, included lower rate of total liabilities, mostly other short-term liabilities. It was also concluded that bank financing didn't play any significant role in the sector because the companies are mostly using equity based financing which is supported by the high profitability of the sector. Thus, smaller companies have to rely on support provided by the EU and governmental organizations (Szucs 2015, 62-70).

Bhaskar and Basanta (2012) in their study "Financial Performance Analysis of Two-Wheeler (2W) Automobile Industries in India", studied the financial performance of three leading companies in the two-wheeler industry in India, over a period of nineteen years (1991–2010). Bhaskar and Basanta used various accounting ratios and statistical tools like, multiple regression analysis and correlation analysis to get a sense of the profitability and liquidity trend of the industry as well as the factors affecting them. The study shows that during the finance crisis the selected companies had negative inter-temporal growth but experienced a turn around in 2009–2010 when production and sales started to grow. This resulted in profitability ratios like, net margin, return on investments and return on capital employed as an increase at moderate pace. The major key for the companies was the capability to cover their short-term debts on due dates through strong liquidity position (Bhaskar, Basanta, 2012, 147-164).

Further, Bhaskar and Basanta presented that the companies in this industry depend largely on internal sources of financing rather than bank financing. Regardless the companies were able to meet up the long term creditors' obligations at any point of time, they still failed to create earnings in excess of the interest expenses on the taken debt which results in no additional value on common stocks for shareholders. Bhaskar and Basanta suggests that with price discounts, attractive and easy financing and launching new models in frequent intervals will maintain the growth of a company (Bhaskar, Basanta, 2012, 147-164).

Herciu and Ogrean (2012) made a case study of financial risks in automotive industry. The authors proposed a model by using discriminate analysis to evaluate the financial risk of eight most important companies acting in automotive industry. The analysis integrated five of the most important financial indicators: current ratio, return on investment, debt to equity, total assets turnover, and working capital to total assets. Then Herciu and Ogrean ranked the companies which would result very differently compared to the Global Fortune 500 rank that evaluates companies only based on their level of revenue (Herciu, Ogrean, 2012, 50-55).

The financial risk score calculations showed that only Volkswagen, Nissan and Tata are performing better than industry average in most of the areas. In case of Toyota, General Motors, Honda, Volvo and Tata were all facing liquidity problems according to the current ratios while Ford was way above the average debt to equity ratio. However, none of the companies were not over or under the average at all of the five indicators. Tata ranked as the best performing company and Toyota as the worst in terms of financial risk score. According to Herciu and Ogrean, the automotive industry still remains very profitable at every level: microeconomic, macroeconomic, and global (Herciu, Ogrean, 2012, 50-55).

In their study "Manufacturing firms' performance and productivity: Evidence from North and South European, Scandinavian and Balkan Countries", Lemonakis, Vassakis, Garefalakis and Partalidou (2016) analyzed and compared the financial performance of manufacturing companies in aforementioned countries. The authors also examined the firm's productivity on export intensity, foreign direct investments (FDI), research and development activity (R&D), and financing costs in each country. In addition, they investigated the relation of these macro variables on the competitiveness of the manufacturing companies (Lemonakis, Vassakis, Garefalakis, Partalidou, 2016, 789-797).

The empirical research suggested that during the economic crisis, European and Balkan companies performed the worst while the Scandinavian manufacturing companies were the most dynamic in terms of growth. The authors also had the best financial performance and didn't show any effects of the economic crisis as the 22% average growth of annual sales. However, after 2010, European companies begun to show some improvements in their profitability along the Scandinavians while Balkan countries presented significant reduction. In terms of liquidity, the European companies were the most effective in inventory management that helped them to overcome the financing problems but Scandinavians had the highest labour productivity. This was mainly explained by the size of the company, capital intensity and the use of new technology. The authors suggested that the availability of low cost financing, R&D, innovation, FDI and labour productivity should be supported by policy makers because those factors were found to have positive and significant affects on a company's competitiveness. In addition, for a convergence of financial performance and growth of their manufacture, the European, Scandinavian and Balkan countries should develop the technological and R&D cooperation between each other (Lemonakis, Vassakis, Garefalakis, Partalidou, 2016, 789-797).

Rohit (2015) derived information from financial statements of leading Indian IT companies: Tata Consultancy Services (TCS), Wipro, Infosys and Tech Mahindra, to summarize and compute the financial ratios for a five-year period. In his research "A comparative analysis of the financial performance of selected Indian IT companies during 2010–2014", Rohit used Du Pont analysis to show a company's decisions and activities interact over the course of an accounting period to produce an overall return to the shareholders. The author calculated and compiled different liquidity, activity and profitability ratios from the companies' financial statements. The study resulted that a company called Infosys was the most desirable regarding to majority of the ratios. They had the highest current ratio, debt turnover ratio, earnings per share and return on shareholder's equity. TCS, on the other hand, had the highest return on assets, net margin, working capital turnover and total asset turnover (Rohit 2015, 43-60).

Based on these previous researches can be concluded:

- In Hungarian automotive industry, high profitability was driven by lower rate of total liabilities, mostly short-term liabilties. This was shown by Szucs with ratio analysis. Also, the companies prefer equity based financing and thus, bank financing doesn't play a significant role.

- Also for Indian automobile industry, a strong liquidity position and further, capability to cover the short-term obligations, is the major key for high profitability. This was revealed through various ratios in Bagchi's and Khamrui's multiple regression analysis and correlation analysis.
- Bhaskar and Basanta suggested that price discounts, attractive and easy financing and launching new models in frequent intervals would maintain a company's growth.
- Rohit revealed through Du Pont analysis that the Indian IT companies that had the highest current ratio, debt turnover ratio, earnings per share and return on shareholder's equity, were the most succesful. Also, high return on assets, net margin, working capital turnover and total asset turnover were the drivers of success.

2. FINANCIAL STATEMENT ANALYSIS

2.1. Comparison of accounting methods and their impact to financial analysis

Both companies, Volkswagen and BMW, are using International Financial Reporting Standards (IFRS), and the supplementary requirements of § 315a of the German Commercial Code (HGB). Regarding to balance sheets, there didn't occur any significant differences.

The noteworthy main principles in the companies' accounting policies are:

1. Both companies use straight-line method over its estimated useful life in depreciation of their tangible and intangible assets.
2. Purchased and internally-generated intangible assets are recorded at cost and recognized as asset if it is probable that the use of the asset will generate future economic benefits.
3. All items of property, plant and equipment are measured at acquisition or manufacturing cost, which is determined on the basis of both direct and indirect cost that are directly attributable, less accumulated depreciation and accumulated impairment losses.
4. Vehicles that are leased out under operating leases are recognized at cost and depreciated to their estimated residual value using the straight-line method over the term of the lease.

Table 2. The useful life of tangible and intangible assets (in years)

Item	Volkswagen	BMW
Buildings	20-50	8-50
Site improvements	10-20	8-50
Techinal equipment and machinery	6-12	3-21
Other equipment, factory and office equipment	3-15	2-25

Source: Table compiled by the author and prepared on the basis of data provided in the annual reports of Volkswagen and BMW in 2012–2016.

Both of the companies are using straight line method for depreciation and amortization of tangible and intangible assets in their balance sheet during the studied period. The main difference occurs in the estimated useful lives of their assets. As can be seen from table 2, BMW uses a wider estimation in years. Both companies estimate the useful life of buildings up to 50 years, but BMW has a higher rate for every other assets. This is beneficial for BMW since the assets will depreciate slower, and the depreciation expenses will reduce the taxable income for a longer period of time.

It can be concluded that, in general, the accounting methods used in the companies' balance sheets do not have any strong distinctions and are compiled based on accounting rules set by IFRS. Both companies are also using first-in, first-out (FIFO) accounting method for managing their inventories.

2.2. Comparative analysis of financial statement structures

Common-size analysis, also known as vertical analysis, is a tool that reveals the company's balance sheet and income statement structures. Most commonly, items in balance sheet are divided by the amount of total assets or total liabilities and equity, and items in income statement are divided by the total sales. This is important when comparing companies as the total size of the company's operations and financing varies in absolute figures, and companies might use different currencies. Thus, by analysing the percentages instead of absolute figures, this tool gives more accurate results and trustworthy insight (Robinson *et al*. 2012, 311-312).

2.2.1. Balance sheet

The vertical analysis of the balance sheet of both companies shows very similar distribution. Total current assets compose around 35–38% of total assets, and the proportion of non-current assets amount to approximately 62–65%, which is typical proportions for a manufacturing companies. The figure 3 shows the proportions of Volkswagen's and BMW's main non-current assets: property plant and equipment (PPE), intangible assets, leased products and non-current financial services receivables (FSR), as well as current assets: cash and cash equivalents, short-term investments, accounts receivables, inventories and current FSR to their total assets. As can be seen from figure 3, the distribution has been rather stable for the whole period. In 2012, BMW had more current assets, and consequently, less non-current assets than Volkswagen. However, in 2016, the situation has turned vice versa, which is more favourable for BMW as it is important for a company to have more investments in the long term to develop and expand the business.

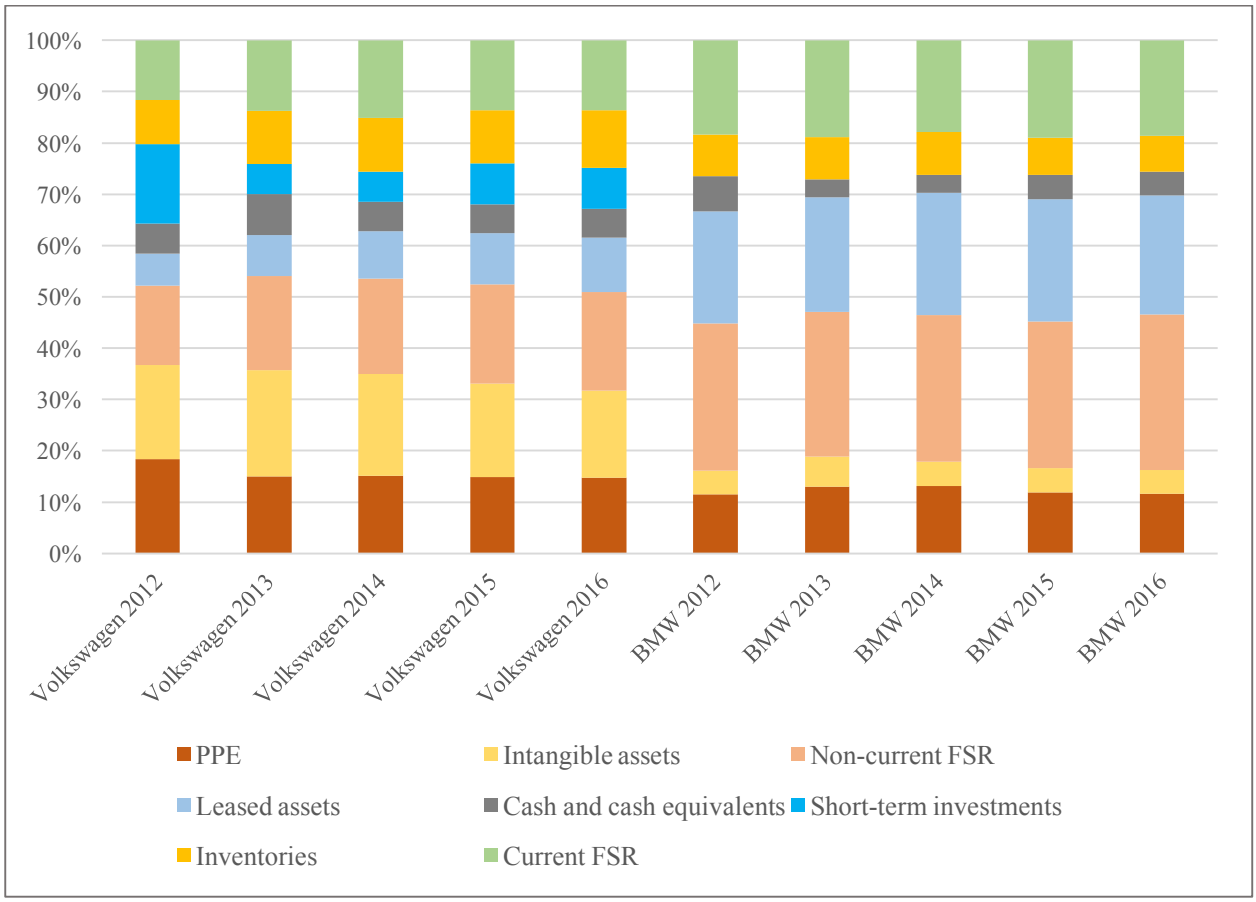

Figure 3. Structure of Volkswagen's and BMW's current and non-current assets in 2012–2016 (in %)
Source: Compiled by the author based on appendix 1.

According to vertical analysis of Volkswagen's balance sheet, the proportion of non-current assets to total assets has decreased from 63.5% to 62.0%, which is not a favourable trend. As can be seen from figure 3, the highest ratio of their both non-current assets and current assets amounted to financial services receivables. According to Volkswagen's annual reports, their current and non-current FSR include mostly customer financing and dealer financing. One of the main reasons behind the increased proportion of current assets was due to increasing current FSR. As the author suggests, the increasing amount of customer and dealer financing might affect the company's cash conversion cycle and liquidity negatively, if the credit terms are too flexible. However, Volkswagen has increased also their marketable securities significantly during the studied period. This account includes mainly short-term fixed-income securities and shares allocated to the available-for-sale financial assets category to safeguard the company's liquidity. Another important reason behind the growth in current assets was due to increasing inventories in response

to growing demand, especially in China. Hence, as the increase in PPE and intangible assets has not been as rapid, the proportion of non-current assets to total assets has decreased during the studied period.

BMW's proportion of non-current assets to total assets has grown from 61.7% to 64.5% during the studied period. As can be seen from figure 3, the highest ratios of their non-current assets amount to non-current FSR and leased assets. Thus, the main reasons behind this growth in non-current assets was the increments in leasing and sales financing activities, especially from 2014 to 2016. In addition, the residual value of their PPE, as well as their intangible assets have increased during the studied period. Consequently, BMW's proportion of current assets to total assets has decreased from 38.3% to 35.5%, primarily due to slower growth in short-term credit financing for retail customers and dealerships, as well as in finance lease receivables. In addition, their proportion of cash and cash equivalents, and inventories have decreased slightly during the studied period.

As can be seen from the figure 4, Volkswagen's proportion of equity to total liabilities and equity has decreased slightly from 25.0% to 22.6% during the studied period, while BMW's has increased from 23.0% to 25.0%. Consequently, the proportion of Volkswagen's total liabilities have increased from 75.0% to 77.4%, whereas BMW's has decreased from 77.0% to 75.0% during the studied period. Within these changes in total liabilities, both companies have a negative trend of decreasing proportion of non-current liabilities to total liabilities. As the author suggests, short-term debt is more expensive than long-term debt, and thus, can weaken the company's liquidity position. However, Volkswagen's situation is much more challenging as their proportion of current liabilities has increased considerably more compared to BMW.

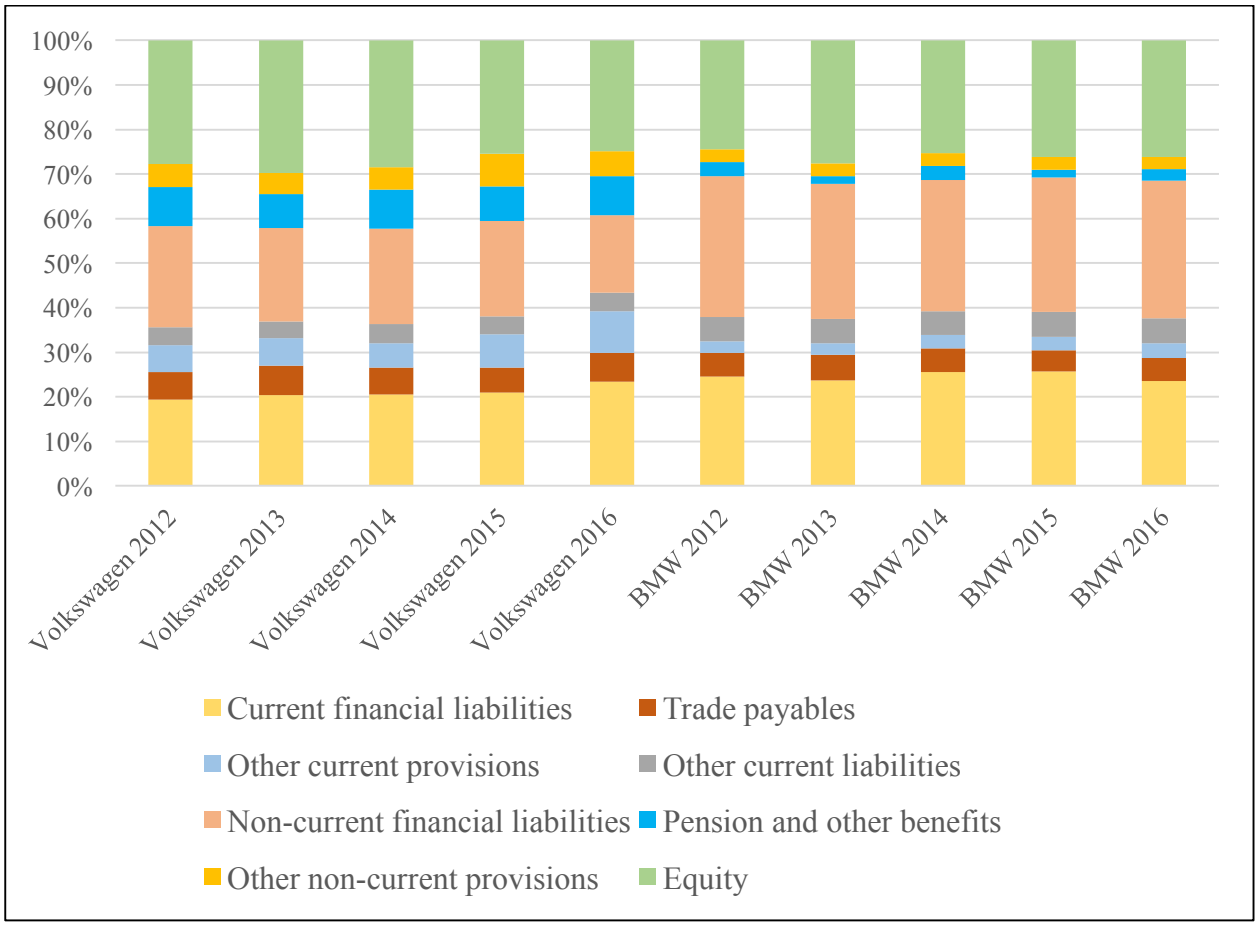

Figure 4. Structure of total liabilities and equity of Volkswagen and BMW in 2012–2016 (in %)
Source: Compiled by the author from appendix 1.

From 2012 to 2013, the proportion of Volkswagen's equity increased from 25.0% to 27.1% reflecting mostly newly issued shares and notes to raise the capital. However, from 2013 to 2016, the proportion of equity has decreased from 27.1% to 22.6% mostly due to decreased retained earnings reflecting weaker net profit from year-to-year.

As can be seen from figure 4, the highest ratio of Volkswagen's both current and non-current liabilities amount to financial liabilities. Their proportion of current liabilities have increased significantly, from 34.1% to 43.4% during the studied period. Volkswagen has been focusing on refinancing to diversify its issues and expansion of its maturity, and thus, their current financial liabilities (including mainly bonds, commercial papers and notes, as well as deposits from direct banking business) have increased notably during the studied period. Another important reason behind the increases in total liabilities was the emission scandal in 2015. Volkswagen has been forced to recognize the provisions for the implementation of field measures and repurchases by

over €10.0 billion, and furthermore, they paid €7.0 billion for legal defence and advice expenses in 2015, and another €3.0 billion in 2016.

As can be seen from figure 4, the highest ratios of BMW's total liabilities were also current and non-current financial liabilities. These liabilities include mainly bonds, commercial papers, liabilities to banks and from customer deposits, as well as asset backed financing transactions. BMW has also been continuously increasing the financing activities, which is the main reason behind the increases in both current and non-current liabilities. Especially in 2014, 2015 and 2016, their liabilities have been increasing due to the implementation of new ABS transactions, issuance of bonds and liabilities to banks. Also, the trade payables have increased every year, which might reflect higher purchase volumes and longer payment terms.

However, as mentioned before, their proportion of total liabilities have decreased due to higher proportion of equity. BMW's equity has increased by roughly €17.0 billion during the studied period, primarily as a result from year-to-year increasing net profit and fair value of gains on derivative financial instruments. According to their annual reports, they have also issued more preferred stock for their employees every year during the studied period. It should be noted that, the higher the proportion of equity the more capable a company is to develop its business independently.

Thus, can be concluded:

- BMW has more preferred trend regarding the assets as their proportion of non-current assets to total assets have increased from 61.7% to 64.5% during the studied period, whereas Volkswagen's proportion of non-current assets have decreased from 63.5% to 62.0%.
- The highest ratio of both companies' total assets were financial services receivables. Consequently, they have increased their total assets primarily through financing and leasing activities over the studied period.
- Volkswagen has had a negative trend in their capital structure changes during the studied period. Firstly, the proportion of total liabilities have increased from 75.0% to 77.4%. Secondly, the proportion of current liabilities have exceeded proportion of non-current liabilities. These changes were primarily caused by refinancing activities and the emission scandal in 2015, resulting in higher proportion of financial liabilities and other provisions.

- It is preferable to have more long-term debts because it allows for potential growth in developments, research and innovations, and are usually secured with assets which allows to have lower interest rates on the debt.
- During the studied period, BMW has had a positive trend of increasing proportion of equity, from 23.0% to 25.0%, reflecting higher profits and newly issued preferred stock from year-to-year.

2.2.2. Income statement

The table 3 demonstrates the proportions of Volkswagen's and BMW's cost of sales, total operating expenses, and net profit to their net sales over the studied period. It shows that the highest proportion of both companies' income statements were cost of sales, varying between 78.8% and 84.1% during the studied period. For Volkswagen, the cost of sales includes mainly cost of research and development, costs of merchandise and production function, as well as all expenses relating to the purchase of materials. For BMW, in turn, the cost of sales includes mostly manufacturing costs, cost of sales relating to financial services business, and research and development expenses.

It can be seen from the table 3 that, BMW has relatively lower and much less volatile proportions of cost of sales and total operating expenses (including distribution expenses, administrative expenses and other operating expenses), which has resulted in more stable net profit during the studied period.

Table 3. Key accounts of Volkswagen's (VW) and BMW's income statements in 2012–2016 (%)

	Cost of sales to net sales	Total operating expenses to net sales	Income taxes to net sales	Profit margin
Volkswagen 2012	81.8	17.6	1.9	11.4
Volkswagen 2013	81.9	17.2	1.7	5.1
Volkswagen 2014	82.0	17.1	1.8	5.5
Volkswagen 2015	84.1	23.9	0	-0.6
Volkswagen 2016	81.1	21.6	0.9	2.5
BMW 2012	79.8	10.4	3.5	6.7
BMW 2013	79.9	10.8	3.4	7.0
BMW 2014	78.8	10.9	3.6	7.2
BMW 2015	80.3	10.2	3.1	6.9
BMW 2016	80.1	10.6	2.9	7.3

Source: Compiled by the author from appendix 2.

As can be seen from table 3, BMW's profit margin has been increasing almost every year due to both decreased proportion of income taxes and slower growth in cost of sales and total operating expenses in respect to growth in sales. The administrative expenses have increased during the studied period mainly as a result of higher expenses for centralised IT activities and new IT projects. However, their research and development expenses have decreased due to production starts of various development-intensive vehicle projects in previous years.

In contrast, Volkswagen's cost of sales and total operating expenses have increased from 2012 to 2015. Most of the increases occurred in 2015 due to the emission scandal as they were forced to recognize provisions in the total amount of €14.6 billion. Thereof €7.5 billion were due to recognition of provisions for field activities such as service measures and recalls, as well as for possible conversions. Also, another €6.7 billion were recognized for legal risks. Rest of the expenses were due to losses from foreign currency hedging derivatives, and miscellaneous expenses, which were largely due to the litigation expenses in connection with the diesel issue. However, according to Volkswagen's annual report, their sales haven't been affected significantly by the scandal and hence, the sales have increased 2.2% on average during the studied period. Consequently, the business has turned back to profitable in 2016 as they have managed to cut the operating expenses and cost of sales by roughly €4.3 billion, even though €5.7 billion expenses were still recognized in 2016.

Thus, can be concluded:

- Cost of sales (mostly including purchase of materials and production functions, costs of merchandise, manufacturing costs, and research and development expenses) comprises highest proportion of both companies' income statements.
- BMW's cost of sales has increased during the studied period, from 79.8% to 80.1 %. However, they have managed to keep the increase more stable and slower, which is a positive trend. Volkswagen, on the other hand, has managed to cut down its proportion of cost of sales slightly from 81.8% to 81.1%, which is a favourable trend along with continuous increments in net sales.
- BMW has managed to increase its profit margin almost every year (from 6.7% to 7.3%) mostly due to decreased proportion of income taxes (from 3.5% to 2.7%).
- Volkswagen has experienced negative trend of increasing cost of sales and total operating expenses from 2012 to 2015, mostly due to recognition of obligations and expenses of

€14.6 billion in connection with the emission scandal in 2015. Thus, their profit margin has dropped significantly, from 11.4% to 2.5% during the studied period.

2.2.3. Cash flow statement

The statement of cash flow analysis can provide more powerful and useful insights of company's operating, investing and financing activities by showing any increasing or decreasing trends. (Robinson *et al.* 2012, 277-288).

As can be seen from figure 5, the results from both companies' operating, financing and investing activities are fluctuating significantly. Also, the free cash flow (see appendix 4) is negative in majority of the years for both companies, which can be considered as a negative trend from investors' point of view. The volatility of net change in cash, as well as negative free cash flow reflects the fluctuation of dividend pay-outs. In general, both companies' free cash flow has been mostly either close to zero or negative.

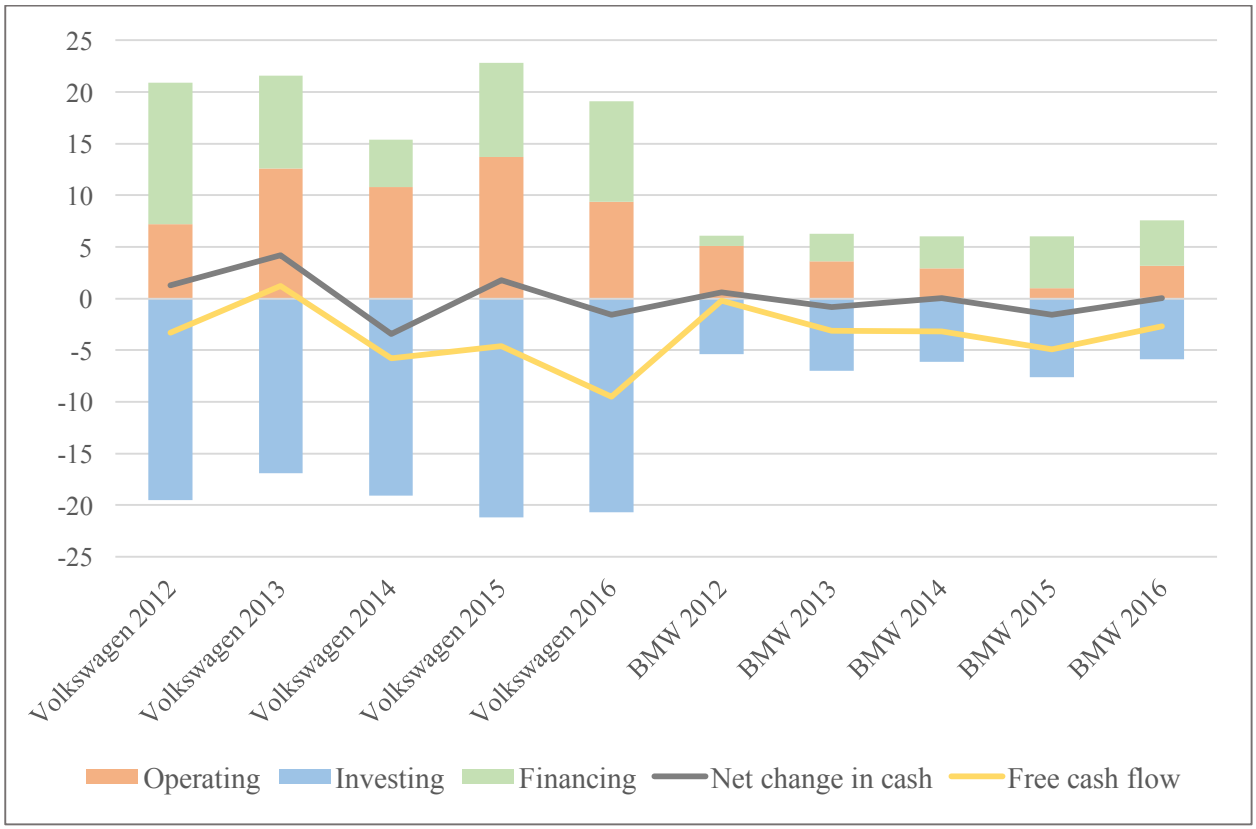

Figure 5. Volkswagen's and BMW's net cash flows from operating, investing and financing activities in 2012–2016 (in billions of euros)
Source: Compiled by the author from appendix 3.

Even though the year 2015 was unprofitable for Volkswagen due to expenses and provisions arising from the emission scandal, it generated the highest operating cash inflows on that year. The operating cash inflow was higher compared to previous years mainly due to nearly €19.7 billion worth of depreciations, amortizations and impairment losses added back. In addition, the change in other working capital was positive and significantly higher than in every other year due to changes in lease assets and financial services receivables.

Volkswagen also were most active in investing activities on 2015, due to roughly €18.2 billion used for acquisition of new property, plant and equipment, as well as €13.2 billion spent for intangible assets. Also, the additions to new equity investment, as well as investments in securities and loans were significantly higher than any other year.

In 2012, however, Volkswagen had the highest positive cash inflow from financing activities. They increased the most capital through issuing new debt on that year while reclaiming relatively less compared to other years. Volkswagen also remained positive on net change in cash even though they had negative effect from exchange rate changes.

In case of BMW, the year 2016 have generated the highest net change in cash of little over €1.7 billion. The cash inflow of €3.2 billion provided by the operating activities was primarily due to higher net profit for the year which also resulted in highest dividend pay-out compared to previous years. In addition, depreciation and amortization of roughly €5.0 billion was added back, and provisions and the change in operating assets and liabilities were positive. The reason for lower cash outflow for investing activities was primarily attributable to lower net investments to marketable securities and investment funds in connection with the Group's liquidity reserve. Such relatively high cash inflow of €4.4 billion from financing activities was primarily due to high amount of new debt issued and significantly higher cash inflow from other financing activities of €4.5 billion. At the same time, BMW also repaid a lot of debts, reducing the net result in conjunction with bonds.

The year 2015 were the most unsuccessful for BMW in terms of both net change in cash and free cash flow. The net change in cash was almost negative €1.6 billion while the free cash flow totalled to negative €4.9 billion. BMW managed to generate only less than €1.0 billion cash inflow from operating activities while using over €7.6 billion into investing activities. This reflects to the €2.3 billion decrease in their cash and cash equivalents in the balance sheet from 2012 to 2015. The main reason behind such poor result from operating activities was due to €9.6 billion outflow from other working capital. According to BMW's annual report, it reflected the increase in receivables from sales financing of over €2.7 billion, offset by a decrease of €0.3 billion in inventories. The principal reasons for higher cash outflow from investing activities were increase in expenditure for investments relating to the acquisition of a shareholding in THERE Holding B.V. Amsterdam, as well as investments in marketable securities and term deposits.

Thus, can be concluded:

- Both companies' capital expenditure is exceeding significantly their operating cash inflows in majority of the years. On the one hand, this can be considered as a positive thing as the company is investing into the growth of the business. However, on the other hand, too low

operating cash inflows are resulting in negative free cash flows and weaker dividend pay-outs.

- Volkswagen's net change in cash has been more positive compared to BMW, but at the same time more volatile, which can be considered as a negative thing from investors' point of view. BMW's net change in cash, in turn, has been much more stable but still either close to zero or negative during the studied period.

2.3. Growth analysis

According to the horizontal and trend analysis of Volkswagen's balance sheet and figure 6, the total assets have increased by 32.0% during the studied period, from €309.6 billion to €409.7 billion. In absolute terms, the total non-current assets have increased roughly €15.0 billion more than total current assets, from €196.6 billion to €254.0 billion. However, their current assets have increased even more in percentage terms during the studied period, from €113.1 billion to €155.7 billion, resulting in the decreasing proportion of non-current assets.

BMW's total assets, in contrast, has increased by roughly 43.0% during the studied period, from €131.9 billion to €188.5. The amount of current assets increased only 32.5%, from €50.5 billion to €66.9 billion during the studied period. In contrast, the non-current assets increased by 49.7%, from €81.3 billion to €121.7 billion, which is a favourable trend in terms of sustainable long-term growth of the business.

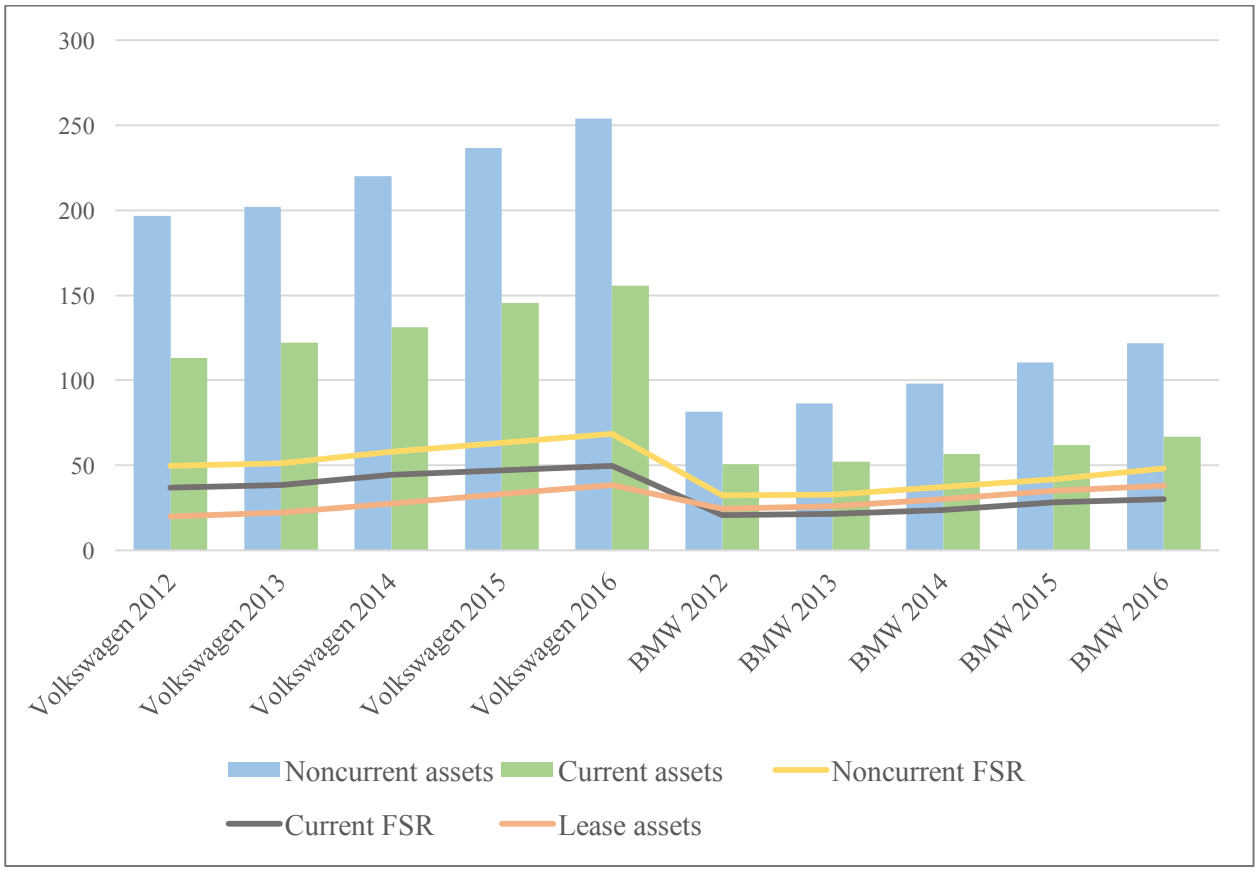

Figure 6. Changes in Volkswagen's and BMW's non-current and current assets in 2012–2016 (in billions of euros)
Source: Compiled by the author from appendix 1.

As mentioned in the vertical analysis of Volkswagen's balance sheet, the proportion of current assets to total assets has increased during the studied period. One of the main reasons behind the faster growth of current assets was the increasing financing and leasing activities in service and insurance areas. The current FSR has increased by 34.7%, from €36.9 billion to €49.7 billion during the studied period. In contrast, their non-current FSR grew only by 29.2%, from €49.8 billion to €68.4 billion during the studied period. The residual value of Volkswagen's PPE has also increased by 37.1%, from €39.4 billion to €54.0 billion during the studied period, but it has not been as rapid as the increments in other current assets. In response to higher demand and sales volume from year-to-year, especially in China, Volkswagen's inventories have increased by another 35.9% during the studied period, from €28.7 billion to €39.0 billion. In addition, the marketable securities have increased significantly by 136.5%, from €7.4 billion to €17.5 billion during the studied period, to safeguard the company's weakening liquidity position.

According to the horizontal analysis of BMW's balance sheet, the increasing activity in sales financing and product leasing was also the main reason behind the faster growth in non-current assets. The non-current receivables from sales financing increased by 48.6%, from €32.3 billion to €48.0 billion during the studied period, and accordingly, the leased products increased by 54.3%, from €24.5 billion to €37.8 billion. The increment in the residual value BMW's PPE were slightly lower compared to Volkswagen, increasing by 35.5%, from €13.3 billion to nearly €18.0 billion. In contrast, the short-term receivables from sales financing increased slightly less by 46.6%, from €20.6 billion to €30.2 billion. BMW has experienced stronger demand in every year as well, which has resulted in not only higher sales but also higher inventories and accounts receivables, increasing together by €2.4 billion during the studied period.

During the studied period, Volkswagen's total liabilities have increased 5.0% more than the total assets, from €227.8 billion to €316.8 billion. Furthermore, the amount of current liabilities has exceeded the amount of non-current liabilities in 2014 as the current liabilities have increased notably during the studied period by 68.2%, from €105.5 billion to €177.5 billion. In contrast, the non-current liabilities have increased only by 13.9%, from €122.3 billion to €139.3 billion. As the author suggests, these changes can be considered as a negative sign due to significantly faster growth of current liabilities in respect to current assets.

BMW's total liabilities have risen by 39.3% during the studied period, from €101.4 billion to €141.2 billion. It can be considered as a favourable trend as the total assets have increased faster, and the proportion of total liabilities to total liabilities and equity has also decreased by 2.0%. Consequently, the proportion of equity has increased by 2.0% reflecting the profits from previous years. The proportion of both current liabilities and non-current liabilities to total liabilities have decreased slightly by 1.0% during the studied period, which is another favourable trend as they still manage to increase the net profit from year-to-year.

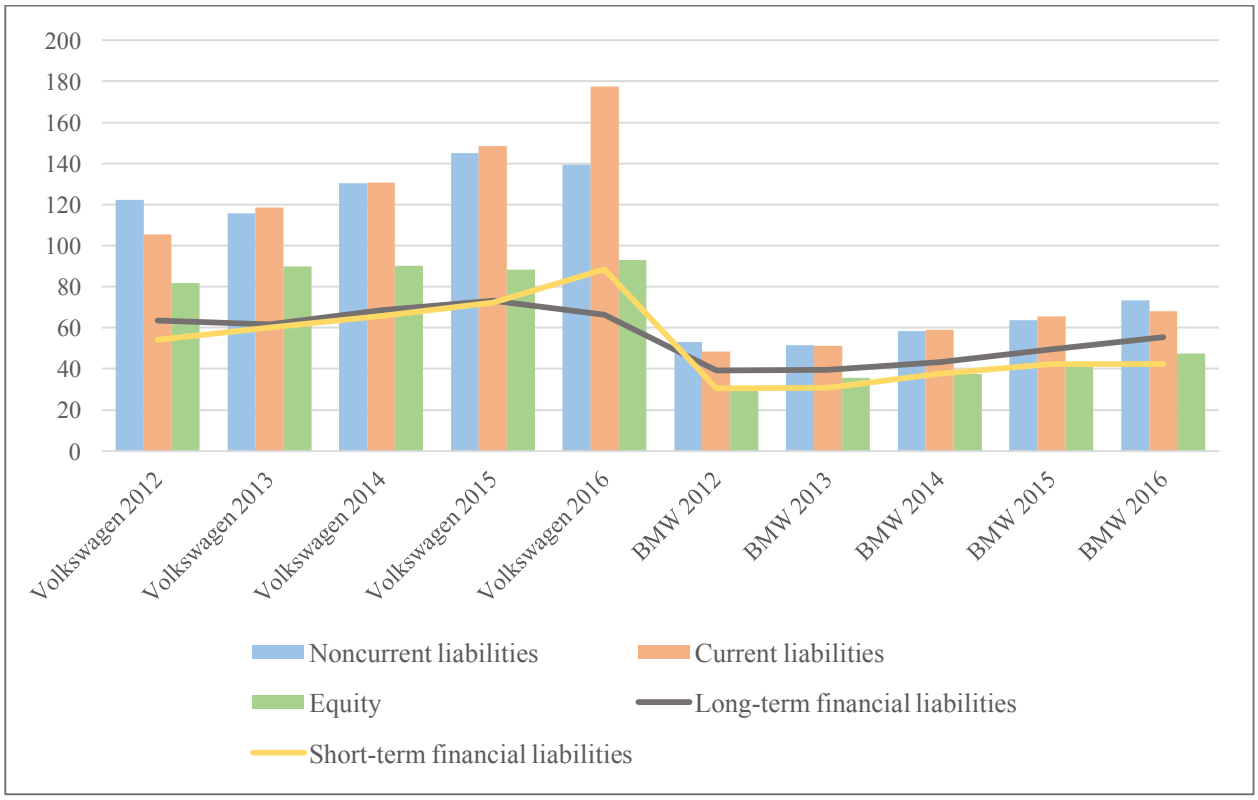

Figure 7. Changes in Volkswagen's and BMW's non-current and current liabilities in 2012–2016 (in billions of euros)
Source: Compiled by the author from appendix 1.

As mentioned in the vertical analysis of Volkswagen's balance sheet, the main reason behind such rapid growth of current liabilities was due to refinancing activities to diversify its issues and expansion of the maturity. This can be seen from figure 7, as the current financial liabilities have increased by 63.6%, from €54.1 billion to €88.5 billion. In addition, the other provisions have increased by over 113.0% during the studied period, from €16.7 billion to €35.7 billion. This reflects the negative impact of the emission scandal as Volkswagen was recognize various expenses specifically in 2015 and 2016. However, in contrast, their long-term solvency position is solid as the non-current assets have exceeded the amount of non-current liabilities during the whole studied period. The emission scandal caused the non-current other provisions to increase by only 49.3%, from €14.3 billion to €21.5 billion. The biggest factor, in absolute terms, behind the growth in non-current liabilities was the increase of provisions for pensions, which increased by 37.5%, from €24.0 billion to €33.0 billion during the studied period. The largest growths occurred in 2014 and 2016, mostly due to lower discount factors used in Germany, The UK, and the USA.

In case of BMW, the current liabilities have increased slightly faster than non-current liabilities during the studied period, but the main reason behind the growth of both short-term and long-term liabilities were the increasing amount of financial liabilities. During the studied period, the current liabilities increased by 40.5%, from €48.4 billion to roughly €68.0 billion. Respectively, the non-current liabilities increased by 38.1%, from €53.0 billion to €73.2 billion. The growth in total amount of financial liabilities were mostly caused between 2014–2016 by the negative impacts of currency and commodity derivatives, and additionally, implementation of ABS transactions, newly issued bonds, and liabilities to banks. During the studied period, the long-term financial liabilities went up by 41.7%, from €39.1 billion to €55.4 billion. Respectively, the short-term financial liabilities increased slightly less by 39.1%, from €30.4 billion to €42.3 billion.

BMW's net profit has been increasing every year in absolute terms, as they have managed to stunt the growth of cost of sales and total operating expenses, while the sales volume has been increasing 6.4% on average from year to year during the studied period. Especially the years 2014 and 2016 were successful due to more rapid growth of sales revenues compared to cost of sales and total operating expenses. Administrative expenses went up mainly as a result of higher expenses for centralised IT activities and new IT projects, but research and development expenses fell due to production starts of various development-intensive vehicle projects in previous years.

To conclude:

- Both companies have an industry typical and healthy proportions of non-current and current assets to total assets, and any significant changes in proportions didn't occur during the studied period. This can be considered as a positive sign.
- BMW's non-current assets have increased faster than current assets during the studied period, which is a positive trend due to more sustainable growth of the business in the long-term. Their non-current assets increased by 49.7%, from €81.3 billion to €121.7 billion, whereas the current assets increased only 32.5%, from €50.5 billion to €66.9 billion during the studied period.
- The growth in Volkswagen's non-current assets have been slower in percentage terms compared to current assets, which could be considered as an unfavourable trend. Their non-current assets increased by only 29.2%, from €196.6 billion to €254.0 billion. In contrast, their current assets increased by 37.7%, from €113.1 billion to €155.7 billion.

- Both companies have increased their activity in financing services and leasing during the studied period, resulting in higher amount of financial services receivables and leased assets. Also, stronger demand from year-to-year reflects the increasing inventories and trade receivables from 2012 to 2016.
- BMW is performing more strongly as the growth in their equity has been greater compared to total liabilities, in percentage terms. Their equity increased by 55.5%, from €30.3 billion to €47.1 billion, where as their total liabilities increased by only 39.3%, from €101.6 billion to €141.4 billion during the studied period. Also, their current liabilities have grown more than non-current liabilities in percentage terms, which could be considered as a negative sign. However, as the author suggest, the
- Volkswagen's equity has increased by only 19.6% during the studied period, whereas their total liabilities increased by 36.6%. They have been focusing on refinancing activities to diversify its issues and expanding the maturity, which has caused the current liabilities to exceed non-current liabilities since 2013. The short-term financial liabilities have increased by 63.6%, from €54.1 billion to €88.5 billion, which has been the main reason behind such significant increases in current liabilities. In addition, the emission scandal in 2015 has caused significant increases in their current liabilities as the other provisions by 108.8%, from €17.1 billion to €35.7 billion, in 2014–2016.

2.4. Analysis of resource usage efficiency

2.4.1. Asset efficiency analysis

The first ratio of asset efficiency analysis is the asset turnover ratio, which measures the company's efficiency and capability to generate sales with its assets. In addition, it reflects how many euros of sales the assets are generating per one euro of assets. Asset turnover belongs to a group of activity ratios, which in general, reflects how efficiently a company is allocating and using its assets to generate sales, and further, convert it to cash (Sharma 2008, 196).

As can be seen from table 4, both companies have a negative trend of decreasing asset turnover ratio. This either means that their sales are decreasing in respect to the total assets, or their asset base have been increasing faster than sales. It should be noted that in manufacturing industry the asset turnover ratios tend to be quite low as the companies have a relatively large asset bases.

Table 4. Asset turnover and sales revenue of Volkswagen and BMW in 2012–2016

Company	2012	2013	2014	2015	2016
Volkswagen's sales revenue (in billions of euros)	192.7	197.0	202.5	213.3	217.3
Volkswagen's asset turnover	0.76	0.62	0.60	0.58	0.55
BMW's sales revenue (in billions of euros)	76.8	76.1	80.4	92.2	94.2
BMW's asset turnover	0.60	0.57	0.52	0.49	0.51

Source: Table compiled by the author on the basis of appendices 1, 2 and 4.

As can be seen from table 4, Volkswagen's sales revenue has been increasing from year to year. Thus, it can be concluded that the reason behind the decreasing asset turnover ratio is that their total assets have been increasing faster than the sales revenue. As the horizontal analysis of the companies' balance sheets showed, Volkswagen's total assets increased by 7.3% on average during the studied period. However, the sales revenues have been growing only 3.0% on average during the studied period. Hence, their asset turnover has dropped by 24.6% from 2012 to 2016.

BMW is also experiencing the same decreasing trend. Their sales revenue has been growing by only 5.2% on average while their total assets have been increasing by 9.7% on average during the studied period. According to table 4, The decline in BMW's asset turnover hasn't been as steep as Volkswagen's, which is more favourable situation for BMW. From 2012 to 2016, their asset turnover ratio has decreased by only 15.3%, which is considerably less. However, the ratio increased from 2015 to 2016 as the growth of total assets slowed down.

In order to get a better sense of asset usage efficiency, the non-current assets should also be analysed. The only difference to asset turnover ratio is that total non-current assets are used as the denominator instead of total assets. Thus, it reflects how efficiently the companies are utilizing their non-current assets to generate revenues, or sales.

As can be seen from table 5, both companies have also a negative trend of decreasing non-current asset turnover ratio, as expected. However, the ratios are higher than total asset turnover ratios due to higher proportions of non-current assets to total assets.

Table 5. Non-current asset turnover of Volkswagen and BMW in 2012–2016 (times)

Company	2012	2013	2014	2015	2016
Volkswagen	1.12	0.99	0.96	0.93	0.89
BMW	0.99	0.91	0.87	0.89	0.81

Source: Table compiled by the author on the basis of appendices 1, 2 and 4.

Volkswagen's total non-current assets have increased by €57.4 billion from 2012 to 2016, which actually covers more than half of the total asset growth. Thus, their non-current asset turnover ratio has decreased by 26.2% during the studied period, which is higher change than in case of total asset turnover ratio. However, as there are no significant decreases in non-current asset turnover ratio during the studied period (as there was in 2013 in total asset turnover), the reason must be more rapid increase of total current assets from 2012 to 2013. As the author considers, non-current assets are more important in terms of growth and development in the long-run.

As can be seen from table 5, BMW's non-current assets have decreased from 0.99 to 0.81 during the studied period, which is a greater change compared to the decrease in total asset turnover ratio. Thus, it reflects the higher proportion of non-current assets, as well as more efficient utilization of the non-current assets compared to current asset. However, in 2015 the ratio increased as the sales revenue grew slightly faster in percentage terms than non-current assets.

Inventory turnover ratio is another important activity ratio. It measures the efficiency of the company's inventory management, and how quickly it can sell and replace its inventory over a certain time period. In general, a high turnover indicates for stronger sales and/or large discounts. Respectively, low turnover implies weaker sales and, therefore, excess inventory (Robinson *et al*. 2012, 323). As can be seen from table 6, Volkswagen has an unfavourable trend of decreasing inventory turnover, whereas BMW has improved its inventory turnover during the studied period.

Table 6. Inventory turnover of Volkswagen and BMW in 2012–2016 (times)

Company	2012	2013	2014	2015	2016
Volkswagen	6.7	6.9	6.7	6.4	5.9
BMW	7.9	7.9	7.8	8.3	8.2

Source: Table compiled by the author on the basis of appendices 1, 2 and 4.

BMW is clearly managing their inventory more efficiently, and selling its products faster. Their inventory turnover has improved slightly by 3.8%, from 7.9 to 8.2 during the studied period. The highest improvement happened in 2015 reflecting an 14.6% increase in sales together with a slight decline in inventories, which was due to 2.8% decrease in finished goods and goods for resale.

In case of Volkswagen, the situation is vice versa. They managed to improve the inventory turnover slightly in 2013 but it has been decreasing ever since. Especially in 2015 and 2016 their sales have slowed down and they forecasted the deliveries incorrectly, which have resulted in

higher inventories, and further, lower inventory turnover.

According to appendix 5, the author calculated the cash conversion cycle (CCC) for both companies. CCC measures the effectiveness of a company's management and, consequently, the overall health of the company. The calculation is measured in days and shows how fast a company can convert its cash on hand into inventory and accounts payable, through sales and accounts receivable, and then back into cash. The ratio comprises of three separate activity ratios: days sales in inventory (DSI), days sales outstanding (DSO), and days payables outstanding (DPO). The CCC is calculated according to the formula provided in appendix 4.

As can be seen from table 7, Volkswagen had significantly longer CCC, which has unfavourably increased almost every year during the studied period. BMW, in turn, has managed to decrease its CCC during the studied period, which is a positive sign.

Table 7. DSI, DSO, DPO and CCC of Volkswagen and BMW in 2012–2016 (in days)

Company	2012	2013	2014	2015	2016
DSI (Volkswagen)	66.4	64.8	69.2	71.3	80.7
DSO (Volkswagen)	19.1	20.6	20.7	19.1	20.5
DPO (Volkswagen)	40.0	40.8	43.0	41.4	47.2
CCC (Volkswagen)	**45.6**	**44.7**	**46.9**	**48.7**	**54.0**
DSI (BMW)	57.9	57.7	63.8	54.6	57.3
DSO (BMW)	12.1	11.8	9.8	10.9	11.0
DPO (BMW)	38.3	44.9	44.4	38.3	41.2
CCC (BMW)	**31.7**	**24.4**	**29.2**	**27.2**	**27.1**

Source: Table prepared by the author on the basis of appendix 4.

According to table 7, BMW has notably shorter CCC than Volkswagen in every year as it has decreased from 31.7 days to 27.1 days during the studied period. Hence, it implies that BMW needs to finance its accounts receivables and/or inventories for a shorter period of time. As the author suggests, this may indicate higher liquidity, as well as more efficient inventory management and credit sales. The reason behind the decreasing CCC is that BMW has managed to stretch out the time they must pay their creditors, DPO, by three days. This allows to have more money on hand, which is positive for working capital and free cash flow. Also, the slight decrease in DSI and DSO reflects faster selling of their inventory and shorter collection time of credit sales from customers.

In case of Volkswagen, it took over 8 days longer in 2016 to convert their resource inputs into cash flows, compared to 2012. This was mainly due to increased DSI, from 66.4 days to 80.7 days

during the studied period, meaning it took approximately 15 days longer to sell their products. Also, they have managed to increase the time to pay its suppliers by 7 days, but as the collection time of its credit sales from customers have also slightly increased, the overall change has affected negatively the CCC.

In order to get a clearer picture of the companies' assets usage efficiency, the author has compiled table 8 to show the trends of increments or decrements in asset turnover, non-current asset and inventory turnover ratios, as well as in CCC, during the studied period.

Table 8. Trends in Volkswagen's and BMW's activity ratios and CCC during the studied period (qualitative)

Company	Asset turnover	Non-current asset turnover	Inventory turnover	Cash conversion cycle
Volkswagen	↓	↓	↓	↑
BMW	↓	↓	↑	↓

Source: Compiled by the author and prepared on the basis of tables 5, 6 and 7.

Thus, can be concluded:

- In overall, BMW is using its assets more efficiently as Volkswagen has an unfavourable trend in every measurement.
- Both companies have an unfavourable trend of decreasing total asset and non-current asset turnover, meaning that they are not generating enough sales revenue in respect to the growth of their assets. However, Volkswagen have had a higher total asset and non-current asset turnover ratio during the whole studied period, which implies for more efficient utilization of their assets.
- BMW has been managing its inventory more efficiently as their inventory turnover have been higher than Volkswagen's, and increased during the studied period, whereas Volkswagen's have been decreasing almost every year.
- BMW's has had significantly shorter CCC during the whole studied period, meaning that they are converting its resource inputs faster into cash through sales due to relatively shorter collection time of credit sales from customers, faster sales of inventories, and longer payment time to its suppliers.
- Volkswagen has an unfavourable trend of increasing CCC, from 45.6 days to 54.0 days during the studied period. This was primarily due to higher inventory holding time compared to payment time to suppliers, along with a slight increase in collection time of

credit sales from customers.

2.4.2. Labour force efficiency analysis

The author compiled table 9 to illustrate how much, and in which direction Volkswagen's and BMW's labour, salary and capital per employee are changing. According to companies' annual reports, the number of employees, as well as average salaries and wages, have increased from year to year in both companies. Also, both companies' labour productivity has increased in most year, but BMW's capital per employee has been quite compared to Volkswagen.

Table 9. Net sales, salary and capital per employee (indices)

Company	Index	2012 → 2013	2013 → 2014	2014 → 2015	2015 → 2016
Volkswagen	Labour productivity	**0.97**	0.99	1.02	**0.99**
	Salary per employee	1.02	1.04	1.02	1.00
	Capital per employee	1.01	0.92	1.01	1.01
BMW	Labour productivity	**0.95**	**1.00**	1.09	**1.00**
	Salary per employee	1.00	1.04	1.04	1.06
	Capital per employee	1.02	1.04	0.84	1.23

Source: Table compiled by the author and prepared on the basis of appendix 1 and 2, and formulas provided in appendix 4

In case of Volkswagen, the number of employees have increased by 16.1% while the personnel expenses have increased even faster, by 24.6%, during the studied period. Thus, it has resulted as an increase of almost 7.3% in average salaries and wages per employee in total over the studied period. Volkswagen's labour productivity has been decreasing almost every year during the studied period, as their sales revenues have increased relatively slower than the number of employees. The sales revenues have increased only 3.0% on average from 2012 to 2016, while the number of employees have increased over 3.8% on average. Exceptionally from 2014 to 2015, their labour productivity increased due to faster growth of sales revenues compared to growth in number of employees. Volkswagen's capital per employee has been quite steady during the studied period, increasing slightly almost every year. However, from 2013 to 2014, their capital per employee decreased by 8.4%, from €370.9 million to €339.0 million, due to lower amount of capital. Also, it should be noted that, it is considered as a negative trend if capital per employee index is higher, and growing faster than labour productivity index. Hence, years 2012 and 2016 (bolded in table 9) might be evidence of Volkswagen's inefficient use of resources and misleading capital investment strategy.

BMW, in turn, have experienced even bigger increase in these measurements. From 2012 to 2016, the number of their employees have increased 17.8% while the personnel expenses have increased also faster, by 35.2%. This has resulted in an increase of 14.8% in average wages and salaries per employee. BMW's labour productivity has decreased almost every year as a result of slower growth of net sales compared to increase in number of employees. However, during the studied period, their sales revenues have increased 5.2% on average while the number of employees have increased only 4.2% on average, which can be considered as a positive trend. BMW's capital per employee, in turn, has been quite volatile during the studied period. It increased from 2012 to 2014, but declined significantly in 2015 as a result of 30.9% decrease in short-term debts and 19.2% decrease in long-term debts respectively. However, their capital per employee increased 23.0% in 2016, from €826.1 million to €1.0 billion, reflecting increases in short-term debts and long-term debts. BMW has also a negative trend of faster growing capital per employee compared to labour productivity. They have managed to increase their labour productivity faster than capital per employee only from 2014 to 2015, whereas the growth of capital employee has been significantly higher in every other year. As can be seen from table 9, the years from 2012 to 2014, and from 2015 to 2016 are bolded due to negative trend of slower growth in labour productivity compared to capital per employee and salary per employee.

Thus, can be concluded:

- Both companies have difficulties to grow their labour productivity faster than salary and capital per employee during the studied period.
- Also, their capital per employee has been increasing more than labour productivity in most years, which is another negative trend. However, Volkswagen's situation is slightly better as their capital per employee has decreased by 1.5% on average, whereas BMW's has increased 2.4% on average. This means that both companies have too much capital per employee in respect to their ability to utilize their labour force to generate sales revenues.
- However, BMW's labour productivity has increased slightly more, by 1.0% on average, during the studied period. In contrast, Volkswagen's labour productivity has decreased unfavourably 0.7% on average. Thus, it suggests that Volkswagen has too much labour force in respect to their ability to generate sales revenues with its labour force.

2.5. Profitability analysis

Instead of using return on equity (ROE), which analyses only the profitability related to company's owners' equity, the author has chosen to use more specific indicator called return on capital employed (ROCE). In addition to common equity, the indicator ROCE takes debt and other liabilities into consideration as well, providing more precise measurement for company's ability to earn a return on all of the capital it employs. It is also more useful when comparing companies within a capital-intensive industry such as car manufacturing industry (Smith 2010, 139). ROCE is calculated according to the formula provided in appendix 4.

However, the value of the ROCE is based on more than just one calculation. According to the component analysis of profitability, the value depends on the three following ratios: profit margin, which measures the company's return on sales; asset turnover, which reflects asset usage efficiency; and equity multiplier, which indicates the amount of financial leverage used by the company. The ROCE can be interpret in two different ways. By analysing the components within the indicator, it can be seen which of the factors had the highest impact on overall changes in ROCE. Another way is to analyse the changes in ROCE which reflects possible trends such as growth or reduction in the company's business efficiency.

According to appendix 6, BMW has performed better on average in terms of ROCE. During the studied period, the average ROCE for BMW was 6.7%, and respectively, 5.7% for Volkswagen. Also, BMW has kept its ROCE much steadier and in a positive trend, increasing from 4.5% to 6.1% during the studied period. In contrast, Volkswagen's ROCE has been varying widely, and decreased from 13.0% to 3.3% during the studied period. In order to fully understand what has caused these changes in ROCE, it is necessary to analyse the dynamics of each factor that have an affection on this indicator.

The first factor is equity multiplier, also known as, financial leverage. As the company's average assets increase more compared to average equity and borrowings, or vice versa, the ROCE is increasing as well, keeping other factors unchanged. Thus, the higher the financial leverage the more financially dependent the company is. The optimum level of financial leverage should be thought in a way that the company gets the most out of tax benefits due to debt usage, but at the same time avoids potential bankruptcy.

The calculations show that BMW is financially more independent as its equity multiplier varies between 0.83 and 1.20, whereas Volkswagen's equity multiplier varies between 1.44 and 1.53. Both companies are experiencing an increasing trend in equity multiplier, meaning that they have increased their financial leverage to finance their assets during the studied period, and consequently, putting their financial health into more risky position. It should be noted that, as the company uses more financial leverage, it is more prone to changes in interest rates.

Second ratio in the component analysis is asset turnover, which indicates how efficiently the company's uses its assets to generate sales revenues. It should be noted that, the asset turnover ratio depends on the company's asset structure. Further, as the car manufacturing industry typically has a higher non-current assets base, it tends to lower the asset turnover ratio due to longer depreciation of such assets.

As can be seen from the asset efficiency analysis, both companies had a negative trend of steadily decreasing asset turnover ratio. For Volkswagen, it has decreased from 0.68 to 0.55, and for BMW from 0.60 to 0.52 respectively. It can be concluded from the calculations in appendix 6 that the ROCE indicator tends to fall as the asset turnover ratio decreases as well. As the horizontal and trend analysis of income statement proved, the sales of both companies are increasing year to year. Thus, the decreasing asset turnover ratio reflects the lack of improvement in asset management and utilization.

The third and last component is return on sales. It might not be considered as the best, or most descriptive, measurement of the company's profitability, but it is the most commonly used indicator to measure and evaluate the company's efficiency on operational activities. The management of this ratio focuses on optimizing the production costs, sales volumes and product prices. It should be noted that, the overall condition of the economy and business environment must be considered when analysing return on sales. For example, if the economy is in recession, it is considered as positive to have a stable return on sales ratio. However, if the economic conditions are improving, a stable return on sales ratio can reflect inefficient management.

During the studied period, the highest ratio of return on sales for Volkswagen was 13.2%, and, 10.2% for BMW respectively. However, Volkswagen's average return on sales has been only 6.0% during the studied period, whereas BMW's has been 9.6% on average. Also, BMW's return on sales has been much steadier, increasing from 9.0% to 9.7% during the studied period. In contrast,

Volkswagen's has decreased significantly, from 13.2% to 3.4%, being much more volatile. Hence, BMW is performing much better in terms of return on sales. It can also be concluded that, the ROCE tends to fall as the return on sales decreases, and vice versa.

To see which component had the highest impact on changes in ROCE, the method of chain substitution needs to be analysed. Thus, by using conditional parameters T', T'' and Tn, and calculating their differences separately to the actual value of T, can be concluded which component has caused the greatest increases or decreases in ROCE. Finally, the overall changes (TΔ) between the parameters are calculated.

Thus, according to the calculations, it can be concluded:

- BMW is performing slightly better, as it has slightly higher average ROCE of 6.0% during the studied period, whereas Volkswagen's is 5.6% on average. Also, BMW has much steadier ROCE which is another positive trend.
- During the studied period, the changes in return on sales has caused majority of the decreases in ROCE for Volkswagen, as their return on sales has dropped significantly from 13.2% to 3.4%. This was mostly due to a significant amount of other operating expenses and obligations recognized from the emission scandal.
- In case of BMW, the ROCE has increased from 4.5% to 6.1%, reflecting primarily changes in return on sales and asset turnover. Even though, their asset turnover has declined steadily during the studied period, the ROCE has increased from 2012 to 2014 mainly due to even higher increases in return on sales. However, the ROCE has declined slightly from 2014 to 2016 as a result from decreasing asset turnover from 0.56 to 0.52. As occurred in labour efficiency analyses, BMW's staff costs might be increasing too much, generating higher operating expenses, and consequently, reducing the return on sales. In addition, asset efficiency analysis showed that, there should be improvement done regarding the management of optimizing their asset usage.

2.6. Matrix analysis

The matrix analysis is an organized matrix model that was initially represented by an Estonian researcher Uno Mereste to reflect the overall assessment of a company's economic efficiency. The model comprises of initial quantitative indicators, which are affected by several other qualitative

indicators. Furthermore, the initial indicators can be categorized in three groups: resources, expenses and results. The order of the quantitative indicators is organized in a way that the company's resources (inputs) are converted into results (outputs), through expenses (processes). Hence, the growth in results should always be higher than the growth in expenses, as well as in resources (Alver, Järve, 1989).

The author has chosen to use a 5x5 matrix model to use five quantitative indicators, where profit per employee (cell 15) is the objective to be analysed (see table 10). Thus, the changes in profit per employee are depended on the changes located in cells 12, 23, 34 and 45.

Table 10. The analysed matrix model

Quantitative indicator	Operating profit (P)	Net sales (S)	Cost of sales (C)	PPE (M)	Number of employees (E)
P	11 1.0				
S	**12 P/S Profit margin**	22 1.0			
C	13 P/C Profit to cost of sales	**23 S/C Net sales to cost of sales**	33 1.0		
M	14 P/M Profit to PPE	24 S/M Net sales to PPE	**34 C/M Cost of sales to PPE**	44 1.0	
E	**15 P/E Profit per employee**	25 S/E Net sales per employee	35 C/E Cost of sales per employee	**45 M/E PPE per employee**	55 1.0

Source: Compiled by the author based on Mereste 1987, 245; Siimann, Alver 2015.

According to table 10, the author has divided the quantitative indicators in the following categories:

Resource indicators:

- Number of employees (indicator "E")
- Property, plant and equipment (indicator "M")

Expense indicator:

- Cost of sales (indicator "C")

Result indicators:

- Net sales (indicator "S")
- Operating profit (indicator "P")

The order of these indicators is organized in a way that a company initially acquires labour force, and property, plant and equipment to run the processes of the business. Then the resources are converted into results, after deducting any expenses occurring during the processes. Both companies are operating globally, meaning that the taxation of their profits might vary to some extent between countries. Thus, the author chose to use operating profit, whereof the taxes are not reduced, instead of net profit. It should be noted that, the author has chosen to use the initial costs of the PPE to distinguish any differences in Volkswagen's and BMW's depreciation methods. Also, the cost of sales as an expense indicator was chosen due to being the highest proportion to sales revenues of the companies' income statements.

As can be seen from calculations provided in figure 8, both companies' have a negative trend of decreasing operating profit per employee during the studied period. In case of Volkswagen, this was mainly due to decreasing PPE per employee and operating profit to sales. For BMW, it was mostly caused by the decreasing cost of sales to PPE and operating profit to sales accordingly. However, their operating profit per employee is considerably higher and much steadier compared to Volkswagen.

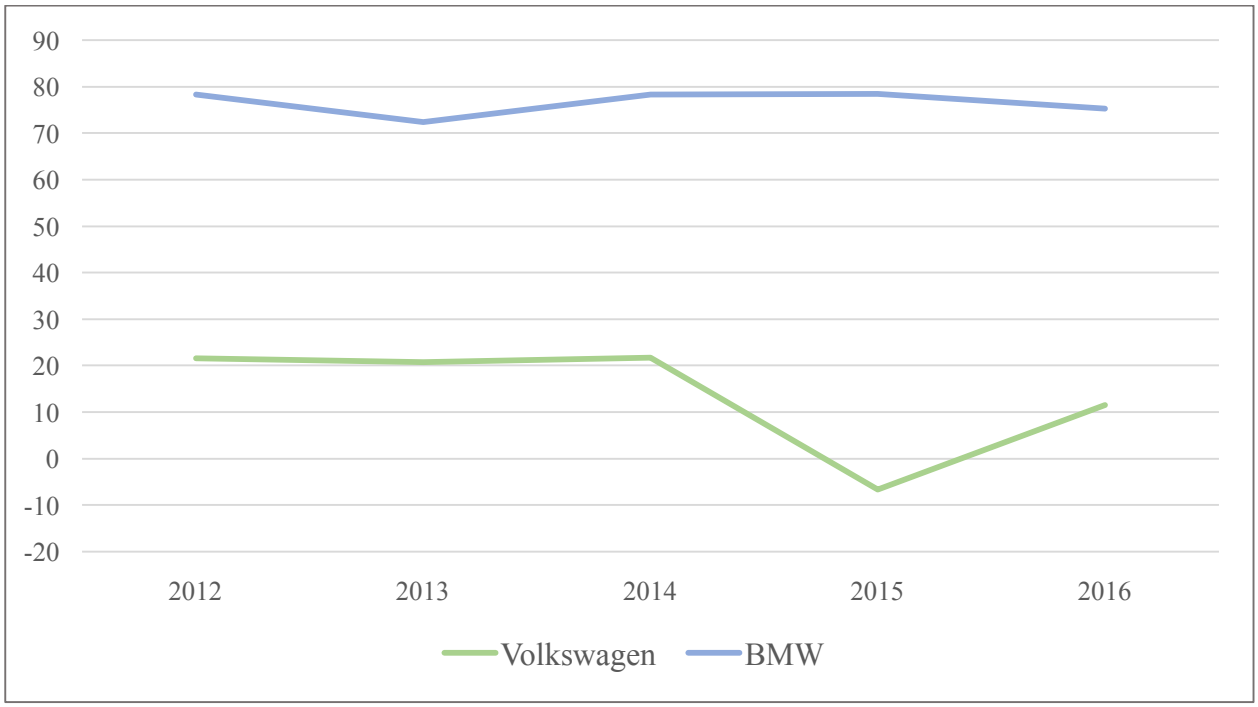

Figure 8. Volkswagen's and BMW's operating profit per employee (P/E) in 2012–2016
Source: Compiled by the author based on appendix 7.

According to appendix 7, BMW's compound annual growth rate (CAGR) of operating profit per employee was -1.0% in 2012–2016, which is not a favourable trend. The largest decrease occurred from 2012 to 2013 as their operating profit per employee dropped from €78.4 million to €72.4 million, which was primarily caused by the cost of sales to PPE (C/M), decreasing from 1.54 to 1.42. This was due to a €0.6 billion decrease in cost of sales, and at the same time, a €2.9 billion increase in gross PPE. However, BMW's operating profit per employee increased back to same almost same level in the very first year, which was mainly caused by two factors. Firstly, their PPE per employee (M/E) increased from €387.9 million to €404.8 million due to faster growth of gross PPE compared to number of employees. From 2013 to 2014, BMW's gross PPE increased by 10.0%, while the number of employees increased by only 0.3%. Secondly, their cost of sales to PPE (C/M) decreased from 1.42 to 1.35, which reflected the slower growth in cost of sales compared to growth in gross PPE. The cost of sales increased only by 2.8% while, as mentioned before, the gross PPE increased by 10.0%. The operating profit per employee decreased yet again by €3.2 million from 2015 to 2016, mostly due to decreased operating profit to sales revenue (P/S). BMW's sales revenue increased by only 2.2%, from €92.2 billion to €94.2 billion, while their operating profit fell by 2.2%. It can be concluded that, these changes reflect higher operating expenses.

However, Volkswagen had even more negative trend in their operating profit per employee as the CAGR in 2012–2016 was -15.0%. The highest impact on their operating profit per employee happened between 2014 and 2015 as it dropped from €21.8 million to €-6.7 million. The main reasons behind this was decreasing operating profit to sales revenue (P/S) as Volkswagen's operating profit dropped significantly by -132.0%, from €12.7 billion to €-4.1 billion. However, their operating profit per employee increased notably in the very next year as their business turned back to profitable. This was also caused by the increase in operating profit to sales revenue as the operating profit grew by 74.6%, from €-4.1 billion to €7.1 billion in 2015–2016.

Table 11. The highest impact on P/E by other components (%)

Company	2013/2012	2014/2013	2015/2014	2016/2015
Volkswagen	482% – M/E	116% – P/S	101% – P/S	100% – P/S
BMW	103% – C/M	97% – P/S	8658% – M/E	103% – P/S

Source: Compiled by the author based on appendix 8.

As can be seen from table 11, the changes in both companies' operating profit per employee were mostly caused by same factors, PPE per employee (M/E) and operating margin (P/S). This can be considered as logical because the automotive industry is highly capital intensive, as mentioned before. Thus, the quantity of employees, and consequently, labour productivity, as well as management of operating expenses and PPE has the greatest affection on the companies' profitability. Also, the value of sales revenues as well as the results after operating expenses (operating profit), depends highly on the business performance.

2.7. Ranking the companies based on overall performance efficiency indicator (OPEI)

Overall performance efficiency indicator (OPEI) is a measurement used for ranking companies based on the dynamics in the economic efficiency of their business activities. Furthermore, the purpose of this indicator is to summarize all changes in individual components in the level of efficiency into a single value (Alver, 2015, 12).

According to Uno Mereste's studies (1984, 156), companies can be ranked by their OPEI using the arithmetic mean from the indices of the matrix variable composition. The formula (1) is following:

$$I_E = \frac{2\sum I_{ij}}{n^2 - n}$$

where

I – the index of variable composition

n – the number of initial quantitative indicators

The second alternative way of calculating OPEI was introduced by Root in his PhD thesis in 1983 as he used geometric mean of the indices of the matrix variable. The formula (2) is following:

$$I_E = \sqrt[\frac{n^2-n}{2}]{\prod\prod I_{ij}}$$

The author has chosen BMW as the basic company in OPEI comparison with Volkswagen due to operating loss in 2015 in case of Volkswagen. Hence, as can be seen from table 12, the overall performance efficiency indicator in 2015 is not comparable between the companies.

Table 12. OPEI of BMW by arithmetic mean compared to Volkswagen during 2012–2016 (%)

Company	2012	2013	2014	2015	2016
BMW/Volkswagen	89%	78%	81%	–	160%

Source: Compiled by the author based on appendix 10

According to table 12, can be concluded that, BMW's efficiency has been much higher every year by arithmetic mean compared to Volkswagen. The highest efficiency occurred in 2016 as the OPEI of BMW by arithmetic mean was 160.0% due to significantly higher operating profit to PPE and operating profit per employee, compared to Volkswagen and other years. Furthermore, according to appendix 10, the geometric mean was 100%, meaning that BMW was twice as efficient as Volkswagen.

CONCLUSION

The purpose of this study was to show the effects of the emission scandal to Volkswagen's financial statements and, compare the differences to BMW's performance during the studied period. Furthermore, the objective of this study was two globally operating and German based companies, Volkswagen Group and BMW group, based on their annual reports in 2012–2016.

To answer the first research question "How does the Volkswagen's and BMW's **capital and asset structures** differ from each other during the studied period?", the following conclusions can be made based on the vertical analysis of their balance sheets, income statements and cash flow statements:

- BMW has a more sustainable asset structure as they have higher proportion of non-current assets to total assets, increasing from 61.7% to 64.5% during the studied period. This was due to increments financial and leasing activities, as well as increasing residual value of their PPE.
- Volkswagen has unfavourable trend as their proportion of non-current assets to total assets has decreased slightly from 63.5% to 62.0% during the studied period. This was mostly caused by more rapid increase in current FSR, marketable securities and inventories than in the residual value of PPE, non-current FSR and intangible assets.
- Both companies' highest share of both current and non-current liabilities amounted to financial liabilities, which includes mainly bonds, commercial papers and notes, as well as deposits from direct banking business, as well as asset backed financing transactions.
- BMW has a healthier capital structure as their proportion of equity to total liabilities and equity has increased from 23.0% to 25.0%, reflecting higher retained earnings and issuance of new preferred stock to employees every year during the studied period.
- Volkswagen's proportion of current liabilities to total liabilities has increased significantly faster in respect to non-current liabilities, from 34.1% to 43.3% during the studied period. This was due to refinancing activities to diversify their issues and to expand the maturity, as well as the increasing provisions in connection with the emission scandal in 2015.

To answer the second research question "Which company is **more efficient and why** in terms of asset and labour force usage, liquidity, profitability, and is growing faster?" the following conclusions could be made based on the horizontal analysis, asset and labour force efficiency analysis, and profitability analysis:

- BMW's total assets have increased by 43.0%, whereof their non-current assets have increased faster in both absolute and percentage terms, which is more favourable. In addition, their total liabilities have increased only by 39.3%, and accordingly, equity by 55.5%, which is another favourable trend.
- Volkswagen's total liabilities have increased by 36.6%, whereas their total assets grew only by 32.3% during the studied period. Most of the growth in total liabilities was caused by rapidly increasing current liabilities, which has exceeded the amount of non-current liabilities during the studied period. These are negative changes.
- Both companies have an unfavourable trend of decreasing total asset and non-current asset turnover, meaning that they are not generating enough sales revenue in respect to the growth of their assets. However, Volkswagen have had a higher total asset and non-current asset turnover ratio during the whole studied period, which implies for more efficient utilization of their assets.
- Cost of sales comprises the highest proportion of both companies' income statements. This includes mainly purchase of materials and production functions, costs of merchandise, manufacturing costs, and research and development expenses.
- BMW's profit margin has increased from 6.7% to 7.3% during the studied period, which was mostly due to decreased proportion of income taxes, as well as slower growth of cost of sales compared to sales revenues in most years.
- Volkswagen has experienced a negative trend of decreasing net profit as it has dropped significantly from 11.4% to 2.5% during the studied period. This was mostly caused by the increasing proportions of distribution expenses. The largest drop occurred in 2015 as Volkswagen was forced to recognize obligations and expenses in connection with the emission scandal. This resulted in increasing proportion of other operating expenses.
- Both companies' operating, financing and investing activities are fluctuating quite a lot, and the free cash flow is negative in majority of the years, which can be considered as a negative trend from investors' point of view.
- Both companies' capital expenditure has also exceeded their operating cash inflows significantly in majority of the years during the studied period. On the one hand, this can be considered as a positive sign, because the companies are investing into the growth of their business. On the other hand, too low operating cash inflow has resulted in continuous negative free cash flow, which affects the dividend pay-outs negatively.

- Volkswagen's net change in cash has been more positive on average, but at the same time more volatile compared to BMW, which is a negative trend. In contrast, BMW's net change in cash has been much more stable, but still either close to zero, or negative.
- BMW has been managing its inventory more efficiently as their inventory turnover have been higher than Volkswagen's, and increased during the studied period, whereas Volkswagen's have been decreasing almost every year.
- BMW's has also had significantly shorter, and decreasing, CCC during the whole studied period. This was reflected by faster conversion of resource inputs into cash through sales due to shorter collection time of credit sales from customers, more efficient inventory management, and longer payment time to its suppliers.
- Volkswagen has an unfavourable trend of increasing CCC, which was primarily due to higher and faster growth of inventory holding time compared to increase in their payment time to suppliers.
- Both companies have difficulties to grow their labour productivity faster than salary and capital per employee during the studied period, mostly due to faster growth of capital per employee in most years in respect to labour productivity.
- However, BMW is using its labour force more efficiently as their labour productivity has increased slightly during the studied period. In contrast, Volkswagen's labour productivity has decreased during the studied period, which is a negative trend.
- Even though BMW's asset turnover has declined steadily during the studied period, their ROCE has increased from 4.5% to 6.1% reflecting primarily even higher increases in return on sales.
- BMW is performing better in terms of profitability as its ROCE has been higher compared to Volkswagen in majority of the years during the studied period. This was mostly due to higher return on sales. Also, BMW has much steadier ROCE which is another positive trend.

To answer the third research question "Which company has **higher profit per employee**, and which components had the **biggest impact** on that?", the following conclusion could be made based on the matrix analysis:

- During the studied period, BMW's operating profit per employee decreased from 78.4 to 75.3, and Volkswagen's from 21.6 to 11.5. Thus, BMW's operating profit per employee has been considerably higher and much steadier compared to Volkswagen. However, both

companies' have a negative trend of decreasing operating profit per employee during the studied period. In case of Volkswagen, this was mainly due to decreasing PPE per employee and operating profit to sales. For BMW, it was mostly caused by the decreasing cost of sales to PPE and operating profit to sales accordingly.

- Quantity of employees, and consequently, labour productivity, as well as the management of operating expenses and PPE has the greatest affection on the companies' profitability as the changes in both companies' operating profit per employee were mostly caused by PPE per employee (M/E) and operating profit on sales revenue (P/S).

To answer the fourth and final research question "Which company has been **more efficient in terms of relative intensity**?", the following conclusions could be made based on the OPEI calculations:

- BMW has been more efficient in terms of relative intensity, as the OPEI of BMW on Volkswagen was significantly higher during the studied period. The geometric mean was 2.00, meaning that BMW was 100% more efficient compared to Volkswagen.
- BMW's efficiency was reflecting mostly higher operating profit to PPE and operating profit per employee.

Based on the findings from the conducted analysis, the author provides the following recommendations to improve the companies' efficiency:

- Volkswagen should focus on their asset structure by increasing the sustainability of their business growth through higher proportion of non-current assets. Furthermore, they focus on the allocation and utilization of their assets. Thus, by improving their efficiency through total asset and non-current asset turnover, they could also affect their profitability positively through improvements in ROCE.
- In addition, Volkswagen should focus on shortening their cash conversion cycle. As their DPO is already relatively high and increment in DSI was mostly caused by temporary slowdown in the growth of sales, the CCC could be improved through DSO. Firstly, the DSO could be shortened by tightening their credit sales terms to get cash earlier from customers, as long as it doesn't affect their sales volume and demand negatively. Another option would be factoring, meaning that they sell their trade receivables to a third party to get cash earlier as well.

- As both companies had difficulties on growing their labour productivity faster than capital and salary per employee. Hence, they should focus either on reducing the quantity of employees and focusing more on the quality, or the amount of capital.
- The matrix analysis showed that the main reason behind the decreasing operating profit per employee in case of Volkswagen was operating margin. Thus, they should also focus on improving the operating profit by cutting their distribution and administrative expenses.
- Both companies have a negative trend of decreasing operating profit per employee. According to component analysis of the matrices, these decreases were mostly caused by PPE per employee and operating margin. Hence, both of the companies should focus on either increasing the share of gross PPE, reducing the quantity of employees, or improving their efficiency in operational level by cutting operating expenses.
- In addition, the comparison matrices showed that, BMW had significantly higher profit per employee than Volkswagen mostly due to higher operating profit to PPE, sales per employee and cost of sales per employee. Thus, Volkswagen should focus on improving their labour productivity, utilization of their PPE or being more cost efficient.

REFERENCES

Alver, J. (2015). *On some new trends in financial statement analysis: the case of Estonia*. Unpublished paper.

Alver, J., Siimann, P. (2015). *On using an efficiency matrix in analysing profit per employee (on the basis of the Estonian SME software sector)*. Zeszyty Teoretyczne Rachunkowosci. 2015, Vol. 83, issue 140.

Bhaskar, B., Basanta, K. (2012). *Financial Performance Analysis of Two-Wheeler (2W) Automobile industries in India*. Vol. 41. 147-164.

BMW Group. (2012–2016). *Annual reports*. Accessible: https://www.bmwgroup.com/en/investor-relations/financial-reports.html , 19 September 2017.

Herciu, M., Ogrean, C. (2013). *Financial Risks – A Case Study for Automotive Industry*. Studies in Business & Economics. Vol. 8. 50-55.

International Organization of Motor Vehicle Manufacturers. (2016). *Automobile production, selected countries, 1950–2016*. Accessible: https://people.hofstra.edu/geotrans/eng/ch2en/conc2en/carprod_evolution.html , 20 December 2017.

International Organization of Motor Vehicle Manufacturers. (2016). *New PC registrations or sales*. Accessible: http://www.oica.net/wp-content/uploads//pc-sales-2016.pdf , 20 December 2017.

International Organization of Motor Vehicle Manufacturers. (2016). *Vehicle type definitions: Passenger cars*. Accessible: http://www.oica.net/wp-content/uploads/DEFINITIONS-VEHICLE-IN-USE1.pdf , 20 December 2017.

International Organization of Motor Vehicle Manufacturers. (2016). *Passenger car sales*. Accessible: http://www.oica.net/wp-content/uploads/pc-sales-2016.jpg , 20 December 2017.

Lemonakis, C., Vassakis, K., Garefalakis, A., Partalidou, X. (2016). *Manufacturing Firms' Performance and Productivity: Evidence from North and South European, Scandinavian and Balkan Countries*. Greece: Scientific Research Publishing Inc. 789-797.

McKinsley&Company. (2013). *The road to 2020 and beyond: What's driving the global automotive industry?*. Accessible: https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/the-road-to-2020-and-beyond-whats-driving-the-global-automotive-industry , 18 December 2017.

Mereste, U. (1984). *Kompleksanalüüs ja efektiivsus*. Tallinn: Valgus.

Mereste, U. (1987). *Majandusanalüüsi teooria*. Tallinn: Valgus.

Robinson, T. R., Henry, E., van Greuning, H., Broihahn, M. A., Cope, A. T., Pirie, W. L. (2012). *International Financial Statement Analysis*. New Jersey: John Wiley&Sons Inc.

Rohit, B. (2015). *A Comparative Analysis of the Financial Performances of Selected Indian IT Companies During 2010–2014*. IUP Journal of Accounting Research & Audit. Vol. 14. 43-60.

Root, A. (1987). *Economic efficiency of production and its matrix modelling (on example of industry of the Estonian SSR)*. Abstract of the PhD thesis. Tallinn.

Sharma, D. (2008). *Working Capital Management: A Conceptual Approach*. Mumbai: Himalaya Publishing House.

Smith, B. (2010). *Introductory Financial Accounting*. New York: McGraw-Hill Education.

Statista. (2017). *Number of cars sold worldwide from 1990 to 2017*. Accessible: https://www.statista.com/statistics/200005/international-car-sales-by-region-since-1990/ , 16 December 2017.

Statista. (2017). *Revenue of the leading automotive manufacturers worldwide FY 2016 (in billions U.S. dollars)*. Accessible: https://www.statista.com/statistics/232958/revenue-of-the-leading-car-manufacturers-worldwide/ , 13 December 2017.

Statista. (2017). *Selected passenger car manufacturers' European market share from January 2017 to October 2017, based on new registrations*. Accessible: https://www.statista.com/statistics/263421/market-share-of-selected-car-maunfacturers-in-europe/ , 15 December 2017.

Statistics Estonia. (2017). *Financial key ratios*. Accessible: http://pub.stat.ee/px-web.2001/I_Databas/Economy/09Financial_statistics_of_enterprises/04Enterprises_financial_key/02Annual_statistics/FS_024.htm , 15 December 2017.

Szucs, G. (2015). *The Financial Analysis of the Hungarian Automotive Industry Based on Profitability and Capital Structure Ratios*. North America: Central European Business Review. Vol. 4. 61-73.

Volkswagen Group. (2012–2016). *Annual reports*. Accessible: https://www.volkswagenag.com/en/InvestorRelations/news-and-publications/Annual_Reports.html , 19 September 2017.

APPENDICES

Appendix 1. Balance sheet

Volkswagen Group Balance sheet 2012–2016 (in millions of euros)

Years	Dec. 31, 2012	Dec. 31, 2013	Dec. 31, 2014	Dec. 31, 2015	Dec. 31, 2016
Intangible assets	59,158	59,243	59,935	61,147	62,599
Property, plant and equipment	39,424	42,389	46,169	50,171	54,033
Lease assets	20,034	22,259	27,585	33,173	38,439
Investment property	433	427	485	504	512
Equity-accounted investments	7,309	7,934	9,874	10,904	8,616
Other equity investments	3,870	3,941	3,683	974	996
Financial services receivables	49,785	51,198	57,877	63,185	68,402
Other financial assets	6,431	7,040	6,498	6,730	8,256
Other receivables	1,671	1,456	1,654	1,340	2,009
Tax receivables	552	633	468	395	392
Deferred tax assets	7,915	5,622	5,878	8,026	9,756
Total non-current assets	**196,582**	**202,141**	**220,106**	**236,548**	**254,010**
Inventories	28,674	28,653	31,466	35,048	38,978
Trade receivables	10,099	11,133	11,472	11,132	12,187
Financial services receivables	36,911	38,386	44,398	46,888	49,673
Other financial assets	5,872	6,591	7,693	10,043	11,844
Other receivables	4,823	5,030	5,080	5,367	5,130
Tax receivables	761	729	1,010	1,029	1,126
Marketable securities	7,433	8,492	10,861	15,007	17,520
Cash, cash equivalents and time deposits	18,488	23,178	19,123	20,871	19,265
Total current assets	**113,061**	**122,192**	**131,102**	**145,387**	**155,722**
Total assets	**309,644**	**324,333**	**351,209**	**381,935**	**409,732**
Subscribed capital	1,191	1,191	1,218	1,283	1,283
Capital reserves	11,509	12,658	14,616	14,551	14,551
Retained earnings	64,815	72,341	71,197	69,039	70,446
Other reserves	0	-459	-2,081	-4,374	-1,158
Equity attributable to Volkswagen AG hybrid capital investors	0	2,004	5,041	7,560	7,567
Equity attributable to Volkswagen AG shareholders and hybrid capital investors	77,515	87,733	89,991	88,060	92,689
Non-controlling interests	4,310	2,304	198	210	221
Total equity	**81,825**	**90,037**	**90,189**	**88,270**	**92,910**
Financial liabilities	63,603	61,517	68,416	73,292	66,358
Other financial liabilities	2,397	2,305	3,954	5,901	4,488
Other liabilities	4,675	4,527	4,238	4,905	5,664
Deferred tax liabilities	9,050	7,894	4,774	4,433	4,745

Appendix 1 continuation

Volkswagen Group Balance sheet 2012–2016 (cont.)

Provisions for pensions	23,969	21,774	29,806	27,535	33,012
Provisions for taxes	4,239	3,674	3,215	3,940	3,556
Other provisions	14,373	13,981	15,910	25,170	21,482
Total non-current liabilities	**122,306**	**115,672**	**130,314**	**145,175**	**139,306**
Put options and compensation rights granted to non-controlling interest shareholders	0	3,638	3,703	3,933	3,849
Financial liabilities	54,060	59,987	65,564	72,313	88,461
Trade payables	17,268	18,024	19,530	20,460	22,794
Tax payables	238	218	256	330	500
Other financial liabilities	4,425	4,526	7,643	10,350	9,438
Other liabilities	11,111	11,004	14,143	14,014	15,461
Provisions for taxes	1,721	2,869	2,791	1,301	1,301
Other provisions	16,689	18,360	17,075	25,788	35,711
Total current liabilities	**105,513**	**118,625**	**130,706**	**148,489**	**177,515**
Total equity and liabilities	**309,644**	**324,333**	**351,209**	**381,935**	**409,732**

Source: Volkswagen annual reports 2012–2016

Appendix 1 continuation

BMW Group Balance sheet 2012–2016 (in millions of euros)

Years	Dec. 31, 2012	Dec. 31, 2013	Dec. 31, 2014	Dec. 31, 2015	Dec. 31, 2016
Intangible assets	5,207	6,179	6,499	7,372	8,157
Property, plant and equipment	13,341	15,168	17,182	17,759	17,960
Leased products	24,468	25,914	30,165	34,965	37,789
Investments accounted for using the equity method	514	638	1,088	2,233	2,546
Other investments	548	553	408	428	560
Receivables from sales financing	32,309	32,616	37,438	41,865	48,032
Financial assets	2,148	2,539	2,024	2,208	2,705
Deferred tax	2,001	1,620	2,061	1,945	2,327
Other assets	800	912	1,094	1,568	1,595
Total non-current assets	**81,336**	**86,193**	**97,959**	**110,343**	**121,671**
Inventories	9,725	9,595	11,089	11,071	11,841
Trade receivables	2,543	2,449	2,153	2,751	2,825
Receivables from sales financing	20,605	21,501	23,586	28,178	30,228
Financial assets	4,612	5,559	5,384	6,635	7,065
Current tax	966	1,151	1,906	2,381	1,938
Other assets	3,648	4,258	5,038	4,693	5,087
Cash and cash equivalents	8,370	7,671	7,688	6,122	7,880
Assets held for sale	45	0	0	0	0
Total current assets	**50,514**	**52,184**	**56,844**	**61,831**	**66,864**
Total assets	**131,850**	**138,377**	**154,803**	**172,174**	**188,535**
Subscribed capital	656	656	656	657	657
Capital reserves	1,973	1,990	2,005	2,027	2,047
Revenue reserves	28,430	33,122	35,621	41,027	44,445
Accumulated other equity	674	356	1,062	-1,181	-41
Minority interest	107	188	217	234	255
Total equity	**30,402**	**35,600**	**37,437**	**42,764**	**47,363**
Pension provisions	3,965	2,303	4,604	3,000	4,587
Other provisions	3,513	3,828	4,268	4,621	5,039
Deferred tax	3,040	2,459	1,974	2,116	2,795
Financial liabilities	39,095	39,450	43,167	49,523	55,405
Other liabilities	3,404	3,603	4,275	4,559	5,357
Total non-current liabilities	**53,017**	**51,643**	**58,288**	**63,819**	**73,183**
Other provisions	3,282	3,412	4,522	5,009	5,879
Current tax	1,482	2,319	1,590	1,441	1,074
Financial liabilities	30,412	30,854	37,482	42,160	42,326
Trade payables	6,433	7,485	7,709	7,773	8,512
Other liabilities	6,792	7,064	7,775	9,208	10,198
Liabilities in conjunction with assets held for sale	30	0	0	0	0
Total current liabilities	**48,431**	**51,134**	**59,078**	**65,591**	**67,989**
Total equity and liabilities	**131,850**	**138,377**	**154,803**	**172,174**	**188,535**

Source: BMW annual reports 2012–2016

Appendix 2. Income Statement

Volkswagen Group Income statement 2012–2016 (in millions of euros)

Years	2012	2013	2014	2015	2016
Sales revenue	192,676	197,007	202,458	213,292	217,267
Cost of sales	-157,518	-161,407	-165,934	-179,382	-176,270
Gross profit	**35,158**	**35,600**	**36,524**	**33,911**	**40,997**
Distribution expenses	-18,850	-19,655	-20,929	-23,515	-22,700
Administrative expenses	-6,223	-6,888	-6,841	-7,197	-7,336
Other operating income	10,496	9,956	10,298	12,905	13,049
Other operating expenses	-9,070	-7,343	-6,992	-20,171	-16,907
Operating profit	**11,510**	**11,671**	**12,697**	**-4,069**	**7,103**
Share of profits and losses of equity-accounted investments	13,568	3,588	3,988	4,387	3,497
Finance costs	-2,552	-2,366	-2,658	-2,393	-3,247
Other financial result	2,967	-465	767	773	-61
Financial result	13,982	757	2,097	2,767	189
Earnings before tax	**25,492**	**12,428**	**14,794**	**-1,301**	**7,292**
Income tax income/expense	-3,608	-3283	-3,726	-59	-1,912
Current	-4,196	-3,733	-3,632	-2,859	-3,273
Deferred	588	449	-94	2,800	1,361
Net profit	**21,884**	**9,145**	**11,068**	**-1,361**	**5,379**

Source: Volkswagen annual reports 2012–2016

Appendix 2 continuation

BMW Group Income statement 2012–2016 (in millions of euros)

Years	2012	2013	2014	2015	2016
Sales revenue	76,848	76,059	80,401	92,175	94,163
Cost of sales	-61,354	-60,791	-63,396	-74,043	-75,442
Gross profit	**15,494**	**15,268**	**17,005**	**18,132**	**18,721**
Selling and administrative expenses	-7,007	-7,257	-7892	-8,633	-9,158
Other operating income	829	842	877	914	670
Other operating expenses	-1,016	-875	-872	-820	-847
Operating profit	**8,300**	**7,978**	**9,118**	**9,593**	**9,386**
Results from equity accounted investments	271	407	655	518	441
Interest and similar income	753	183	200	185	196
Interest and similar expenses	-913	-469	-519	-618	-489
Other financial result	-592	-206	-747	-454	131
Earnings before tax	**7,819**	**7,893**	**8,707**	**9,224**	**9,665**
Income taxes	-2,697	-2,564	-2,890	-2,828	-2,755
Net profit	**5,122**	**5,329**	**5,817**	**6,396**	**6,910**

Source: BMW annual reports 2012–2016

Appendix 2 continuation

Volkswagen's and BMW's Salaries and wages, and number of employees in 2012–2016

Years	2012	2013	2014	2015	2016
Volkswagen's salaries and wages (in millions of euros)	24,050	25,788	27,684	29,301	29,971
Volkswagen's number of employees	533,469	563,066	583,423	604,387	619,346
BMW's salaries and wages (in millions of euros)	7,086	7,401	8,094	8,887	9,581
BMW's number of employees	105,876	110,351	116,324	122,244	124,729

Source: Volkswagen's and BMW's annual reports in 2012–2016

Appendix 3. Cash flow statement

Volkswagen Group Cash flow statement 2012–2016 (in millions of euros)

Years	2012	2013	2014	2015	2016
Cash and cash equivalents at beginning of period	16,495	17,794	22,009	18,634	20,462
Earnings before tax	25,492	12,428	14,794	-1,301	7,292
Income taxes paid	-5,056	-3,107	-4,040	-3,238	-3,315
Depreciation and amortization of, and impairment losses on, intangible assets, property, plant and equipment, and investment property	7,617	8,007	8,761	9,743	10,100
Amortization of and impairment losses on capitalized development costs	1,903	2,464	3,006	3,262	3,586
Impairment losses on equity investments	20	36	172	37	130
Depreciation of and impairment losses on lease assets	3,594	4,179	5,024	6,651	7,107
Gain/loss on disposal of non-current assets and equity investments	-32	-35	-153	-1,581	-222
Share of profit or loss of equity-accounted investments	-11,512	-759	-990	297	377
Other noncash expense/income	-2,031	1,012	-174	2,102	716
Change in inventories	460	-1,021	-2,214	-3,149	-3,637
Change in receivables (excluding financial services)	-56	-1,651	-1,433	-1,807	-2,155
Change in liabilities (excluding financial liabilities)	-236	2,363	4,764	2,807	5,048
Change in provisions	465	2,479	562	18,329	5,966
Change in lease assets	-5,606	-7,112	-8,487	-10,808	-12,074
Change in financial services receivables	-7,814	-6,688	-8,807	-7,663	-9,490
Cash flows from operating activities	**7,209**	**12,595**	**10,784**	**13,679**	**9,430**
Investments in intangible assets (excluding development costs), property, plant and equipment, and investment property	-10,493	-11,385	-12,012	-13,213	-13,152
Additions to capitalized development costs	-2,615	-4,021	-4,601	-5,021	-5,750
Acquisition of subsidiaries	-3,550	-80	-83	-179	-119
Acquisition of other equity investments	-570	-94	-195	-817	-309
Disposal of subsidiaries	0	0	6	0	-7

Appendix 3 continuation

Volkswagen Group Cash flow statement (cont.)

Disposal of other equity investments	14	23	31	3,173	2,190
Proceeds from disposal of intangible assets, property, plant and equipment, and investment property	373	622	403	533	351
Change in investments in securities	-1,133	-810	-2,154	-3,916	-1,245
Change in loans and time deposits	-1,510	-1,144	-492	-1,711	-2,638
Cash flows from investing activities	**-19,482**	**-16,890**	**-19,099**	**-21,151**	**-20,679**
Capital contributions	2,046	3,067	4,932	2,457	–
Dividends paid	-1,673	-1,849	-1,962	-2,516	-364
Capital transactions with non-controlling interest shareholders	-2 101	0	-6 535	0	-3
Other changes	36	-21	15	13	0
Proceeds from issuance of bonds	26,055	22,118	25,608	22,533	14,262
Repayments of bonds	-16,952	-14,614	-21,748	-23,755	-23,601
Changes in other financial liabilities	6,432	285	4,352	10,360	19,455
Lease payments	-132	-14	-17	-23	-36
Cash flows from financing activities	**13,712**	**8,973**	**4,645**	**9,068**	**9,712**
Effect of exchange rate changes on cash and cash equivalents	-141	-462	294	232	-91
Net change in cash and cash equivalents	**1,298**	**4,216**	**-3,375**	**1,828**	**-1,628**
Cash and cash equivalents at end of period	**17,794**	**22,009**	**18,634**	**20,462**	**18,833**
Securities, loans and time deposits	14,352	17,177	18,893	24,613	28,036
Gross liquidity	**32,146**	**39,186**	**37,527**	**45,075**	**46,869**
Total third-party borrowings	-117,663	-121,504	-133,980	-145,604	-154,819
Net liquidity	**-85,517**	**-82,318**	**-96,453**	**-100,530**	**-107,950**

Source: Volkswagen annual reports 2012–2016

Appendix 3 continuation

BMW Group Cash flow statement 2012–2016 (in millions of euros)

Years	2012	2013	2014	2015	2016
Net profit	5,122	5,329	5,817	6,396	6,910
Current tax	2,908	2,581	2,774	2,751	2,670
Other interest and similar income/expenses	-4	147	127	239	131
Depreciation and amortisation of other tangible, intangible and investment assets	3,716	3,832	4,323	4,686	4,998
Change in provisions	446	480	1,103	296	883
Change in leased products	-1,421	-2,048	-2,720	-3,299	-2,526
Change in receivables from sales financing	-3,988	-4,501	-3,898	-6,637	-8,368
Change in deferred taxes	-211	-17	116	77	85
Other non-cash income and expenses items	407	-552	331	47	-15
Gain/loss on disposal of tangible and intangible assets and marketable securities	-16	-21	-63	-144	-4
Result from equity accounted investments	-271	-407	-655	-518	-441
Changes in working capital	1,755	986	-551	-293	-104
Change in inventories	-108	-195	-971	298	-749
Change in trade receivables	744	22	379	-566	-93
Change in trade payables	1,119	1,159	41	-25	738
Change in other operating assets and liabilities	-1,084	969	323	550	1,229
Income taxes paid	-2,462	-2,787	-4,252	-3,323	-2,417
Interest received	179	136	137	132	142
Cash inflow/outflow from operating activities	**5,076**	**4,127**	**2,912**	**960**	**3,173**
Investment in intangible assets and property, plant and equipment	-5,236	-6,693	-6,099	-5,889	-5,823
Proceeds from the disposal of intangible assets and property, plant and equipment	42	22	36	38	10
Expenditure for investments	-171	-76	-99	-746	-338
Proceeds from the disposal of investments	107	137	190	215	140
Investments in marketable securities and investment funds	-1,265	-4,131	-4,216	-6,880	-3,592
Proceeds from the sale of marketable securities and investment funds	1,090	3,250	4,072	5,659	3,740
Cash inflow/outflow from investing activities	**-5,433**	**-7,491**	**-6,116**	**-7,603**	**-5,863**

Appendix 3 continuation

BMW Group Cash flow statement (cont.)

Issue/buy-back of treasury shares	0	0	0	0	0
Payments into equity	19	17	15	23	20
Payment of dividend for the previous year	-1,516	-1,653	-1,715	-1,917	-2,121
Intragroup financing and equity transactions	0	0	0	0	0
Interest paid	-102	-122	-133	-264	-118
Proceeds from the issue of bonds	7,977	8,982	10,892	13,007	13,974
Repayment of bonds	-6,727	-7,242	-7,249	-8,908	-10,374
Proceeds from new non-current other financial liabilities	0	6,626	5,900	9,715	8,952
Repayment of non-current other financial liabilities	0	-4,996	-5,697	-8,802	-8,443
Change in current other financial liabilities	2,159	-721	2,132	2,648	4,135
Change in commercial paper	-858	1,812	-1,012	-498	-1,632
Cash inflow/outflow from financing activities	**952**	**2,703**	**3,133**	**5,004**	**4,393**
Effect of exchange rate on cash and cash equivalents	-14	-89	86	73	17
Effect of changes in composition of Group on cash and cash equivalents	13	47	2	0	38
Change in cash and cash equivalents	**594**	**-703**	**17**	**-1,566**	**1,758**
Cash and cash equivalents as at 1 January	7,776	8,347	7,671	7,688	6,122
Cash and cash equivalents as at 31 December	**8,370**	**7,671**	**7,688**	**6,122**	**7,880**

Source: BMW annual reports 2012–2016

Appendix 4. Formulas

Name	Formulas
Equity multiplier	Average assets / average equity
Salaries and wages per employee	Annual personnel expenses / 12 / average number of employees
Sales per employee or labour productivity	Sales revenue / average number of employees
Capital per employee	(Average equity + short-term debt + long-term debt) / average number of employees
Operating margin	Operating profit / net sales x 100%
Profit margin	Net profit / net sales x 100%
Asset turnover	Net sales / average assets
Non-current asset turnover	Net sales / average non-current assets
Inventory turnover	Net sales / average inventory
Days sales in inventory (DSI)	Inventory / (cost of sales / 365)
Days sales outstanding (DSO)	Trade receivables / (net sales / 365)
Days sales in payables (DPO)	Trade payables / (cost of sales / 365)
Cash conversion cycle	DSI + DSO – DPO
Free cash flow	Net operating cash flow + net investing cash flow

Source: Statistics Estonia, 2017

Appendix 5. Cash conversion cycle

Days sales in inventory (in days)

Company	2012	2013	2014	2015	2016
Volkswagen	66.4	64.8	69.2	71.3	80.7
BMW	57.9	57.6	63.8	54.6	57.3

Calculated based on data provided in appendices 1 and 2, and formula provided in appendix 4

Days sales outstanding (in days)

Company	2012	2013	2014	2015	2016
Volkswagen	19.1	20.6	20.7	19.0	20.5
BMW	12.1	11.8	9.8	10.9	11.0

Calculated based on data provided in appendices 1 and 2, and formula provided in appendix 4

Days payables outstanding (in days)

Company	2012	2013	2014	2015	2016
Volkswagen	40.0	40.8	43.0	41.6	47.2
BMW	38.3	44.9	44.4	38.3	41.2

Calculated based on data provided in appendices 1 and 2, and formula provided in appendix 4

Cash conversion cycle (in days)

Company	2012	2013	2014	2015	2016
Volkswagen	45.6	44.7	46.9	48.7	54.0
BMW	31.7	24.4	29.2	27.2	27.1

Calculated based on data provided in appendices 1 and 2, and formula provided in appendix 4

Appendix 6. Analysis of profitability

Formula for component analysis of return on capital employed

Return on capital employed	=	Financial leverage	x	Asset turnover	x	Return on sales
Earnings before taxes and interest expense / (average equity + borrowings)	=	Average assets / (average equity + borrowings)	x	Sales revenue / average assets	x	Earnings before taxes and interest expense / sales revenue
T	=	a	x	b	x	c

Source: Estonian statistics, 2017

Appendix 6 continuation

Volkswagen's ROCE component analysis in 2012–2016

	2012	2013	2014	2015	2016
T	13.0%	6.2%	6.4%	-0.5%	2.8%
a	1.44	1.46	1.45	1.49	1.53
b	0.68	0.62	0.60	0.58	0.55
c	13.2%	6.8%	7.3%	-0.6%	3.4%

	Formula	2013/2012	2014/2013	2015/2014	2016/2015
1)	$a_1 \times b_0 \times c_0 = T'$				
	T' =	13.3 %	6.1 %	6.5 %	-0.5 %
2)	$a_1 \times b_1 \times c_0 = T''$				
	T'' =	12.0 %	5.9 %	6.3 %	-0.5 %
3)	$a_1 \times b_1 \times c_1 = T_1$				
	T_1=	6.2 %	6.4 %	-0.5 %	2.8 %

	Absolute variance	2013/2012	2014/2013	2015/2014	2016/2015
1)	△T(a)=T'-To	0.2 %	-0.1 %	0.2 %	0.0 %
2)	△T(b)=T''-T'	-1.0 %	-0.3 %	0.0 %	0.0 %
3)	△T(c)=T_1-T''	-6.8 %	0.2 %	-6.9 %	3.3 %
	△T=	-7.6 %	-0.1 %	-6.8 %	3.3 %

	Relative impact	2013/2012	2014/2013	2015/2014	2016/2015
1)	(△T(a)/△T) ×100%	-3.1 %	39.2 %	-2.3 %	-0.4 %
2)	(△T(b)/△T) ×100%	12.8 %	200.3 %	0.5 %	0.5 %
3)	(△T(c)/△T) ×100%	90.3 %	-139.4 %	101.9 %	99.9 %
	Total	100.0%	100.0%	100.0%	100.0%

Source: Compiled by the author based on appendices 1 and 2

Appendix 6 continuation

BMW's ROCE component analysis in 2012–2016

	2012	2013	2014	2015	2016
T	4.5%	6.6%	6.6%	6.2%	6.1%
a	0.83	1.19	1.19	1.18	1.20
b	0.60	0.56	0.55	0.56	0.52
c	9.0%	9.8%	10.2%	9.3%	9.7%

	Formula	2013/2012	2014/2013	2015/2014	2016/2015
1)	$a_1 \times b_0 \times c_0 = T'$				
	T'=	6.4%	6.5%	6.6%	6.3%
2)	$a_1 \times b_1 \times c_0 = T''$				
	T'' =	6.0%	6.4%	6.8%	5.9%
3)	$a_1 \times b_1 \times c_1 = T_1$				
	T_1=	6.6%	6.6%	6.2%	6.1%

	Absolute variance	2013/2012	2014/2013	2015/2014	2016/2015
1)	$\Delta Ta=T'-To$	2.0%	0.0%	0.0%	0.1%
2)	$\Delta Tb=T''-T'$	1.5%	-0.2%	0.2%	-0.4%
3)	$\Delta Tc=T_1-T''$	2.1%	0.1%	-0.4%	-0.1%
	ΔT =	5.6%	-0.1%	-0.3%	-0.4%

	Relative impact	2013/2012	2014/2013	2015/2014	2016/2015
1)	$(\Delta T(a)/ \Delta T) \times 100\%$	35.2%	13.9%	9.5%	-22.6%
2)	$(\Delta T(b)/ \Delta T) \times 100\%$	27.7%	164.5%	-57.6%	93.0%
3)	$(\Delta T(c)/ \Delta T) \times 100\%$	37.1%	-78.4%	148.1%	29.7%
	Total	100.0%	100.0%	100.0%	100.0%

Source: Compiled by the author based on appendices 1 and 2

Appendix 7. Matrix analysis

Volkswagen's matrix analysis during the studied period 2012–2016 (millions of euros)

Year/Component	P	S	C	M	E
P	1				
S	P/S				
2016	3%				
2015	-2%				
2014	6%				
2013	6%				
2012	6%				
2016/2015	-1.71				
2015/2014	-0.30				
2014/2013	1.06				
2013/2012	0.99				
CAGR 2016/2012	0.86				
CAGR 2015/2012	-0.68				
CAGR 2014/2012	1.03				
GR 2013/2012	0.99				
C	P/C	S/C			
2016	4%	1.23			
2015	-2%	1.19			
2014	8%	1.22			
2013	7%	1.22			
2012	7%	1.22			
2016/2015	-1.78	1.04			
2015/2014	-0.30	0.97			
2014/2013	1.06	1.00			
2013/2012	0.99	1.00			
CAGR 2016/2012	0.86	1.00			
CAGR 2015/2012	-0.68	0.99			
CAGR 2014/2012	1.02	1.00			
GR 2013/2012	0.99	1.00			
M	P/M	S/M	C/M		
2016	5%	1.46	1.19		
2015	-3%	1.56	1.31		
2014	10%	1.60	1.31		
2013	10%	1.69	1.38		
2012	8%	1.42	1.16		
2016/2015	-1.61	0.94	0.91		
2015/2014	-0.30	0.98	1.00		
2014/2013	1.00	0.95	0.95		

Appendix 7 continuation

Volkswagen's Matrix analysis (cont.)

2013/2012	1.18	1.19	1.19	
CAGR 2016/2012	0.87	1.01	1.01	
CAGR 2015/2012	-0.71	1.03	1.04	
CAGR 2014/2012	1.09	1.06	1.06	
GR 2013/2012	1.18	1.19	1.19	
E	P/E	S/E	C/E	M/E
2016	11.47	350.80	284.61	239.75
2015	-6.73	352.91	296.80	226.40
2014	21.76	347.02	284.41	217.49
2013	20.73	349.88	286.66	207.60
2012	21.55	361.18	295.28	254.75
2016/2015	-1.70	0.99	0.96	1.06
2015/2014	-0.31	1.02	1.04	1.04
2014/2013	1.05	0.99	0.99	1.05
2013/2012	0.96	0.97	0.97	0.81
CAGR 2016/2012	0.85	0.99	0.99	0.98
CAGR 2015/2012	-0.68	0.99	1.00	0.96
CAGR 2014/2012	1.00	0.98	0.98	0.92
GR 2013/2012	0.96	0.97	0.97	0.81

Source: Compiled by the author based on appendices 1 and 2, and formula provided in table 10

Appendix 7 continuation

BMW's matrix analysis during the studied period 2012–2016 (millions of euros)

Year/Component	P	S	C	M	E
P	1				
S	P/S				
2016	10%				
2015	10%				
2014	11%				
2013	10%				
2012	11%				
2016/2015	0.96				
2015/2014	0.92				
2014/2013	1.08				
2013/2012	0.97				
CAGR 2016/2012	0.98				
CAGR 2015/2012	0.99				
CAGR 2014/2012	1.02				
GR 2013/2012	0.97				
C	P/C	S/C			
2016	12%	1.25			
2015	13%	1.24			
2014	14%	1.27			
2013	13%	1.25			
2012	14%	1.25			
2016/2015	0.96	1.00			
2015/2014	0.90	0.98			
2014/2013	1.09	1.01			
2013/2012	0.97	1.00			
CAGR 2016/2012	0.98	1.00			
CAGR 2015/2012	0.99	1.00			
CAGR 2014/2012	1.03	1.01			
GR 2013/2012	0.97	1.00			
M	P/M	S/M	C/M		
2016	10%	0.97	0.77		
2015	10%	1.00	0.80		
2014	19%	1.71	1.35		
2013	11%	1.01	0.81		
2012	21%	1.93	1.54		
2016/2015	0.93	0.97	0.97		
2015/2014	0.54	0.58	0.60		

Appendix 7 continuation

BMW's Matrix analysis (cont.)

2014/2013	1.83	1.69	1.67	
2013/2012	0.51	0.52	0.52	
CAGR 2016/2012	0.82	0.84	0.84	
CAGR 2015/2012	0.79	0.80	0.80	
CAGR 2014/2012	0.96	0.94	0.94	
GR 2013/2012	0.51	0.52	0.52	
E	P/E	S/E	C/E	M/E
2016	75.25	754.94	604.85	415.21
2015	78.47	754.02	605.70	409.81
2014	78.38	691.18	545.00	404.83
2013	72.35	689.24	550.82	387.91
2012	78.39	725.83	579.49	376.71
2016/2015	0.96	1.00	1.00	1.01
2015/2014	1.00	1.09	1.11	1.01
2014/2013	1.08	1.00	0.99	1.04
2013/2012	0.92	0.95	0.95	1.03
CAGR 2016/2012	0.99	1.01	1.01	1.02
CAGR 2015/2012	1.00	1.01	1.01	1.03
CAGR 2014/2012	1.00	0.98	0.97	1.04
GR 2013/2012	0.92	0.95	0.95	1.03

Source: Compiled by the author based on appendices 1 and 2, and formula provided in table 10

Appendix 8. Component analysis of the matrix coefficient P/E

Formula of operating profit per employee for component analysis

Formula:	P/E =	(M/E) ×	(C/M) ×	(S/C) ×	(P/S)
Where:	Operating profit per employee	PPE per employee	Cost of sales to PPE	Sales revenue to cost of sales	Operating margin
Where:	T =	a ×	b ×	c ×	d

Index of component "a" (Ta/T0) =	$(a_1 \times b_0 \times c_0 \times d_0) / (a_0 \times b_0 \times c_0 \times d_0)$
Index of component "b" (Tb/Ta) =	$(a_1 \times b_1 \times c_0 \times d_0) / (a_1 \times b_0 \times c_0 \times d_0)$
Index of component "c" (Tc/Tb) =	$(a_1 \times b_1 \times c_1 \times d_0) / (a_1 \times b_1 \times c_0 \times d_0)$
Index of component "d" (T_1/Tc) =	$(a_1 \times b_1 \times c_1 \times d_1) / (a_1 \times b_1 \times c_1 \times d_0)$

The absolute impact of component "a":	$\Delta T(a) = Ta - T_0 = (a_1 - a_0) \times b_0 \times c_0 \times d_0$
The absolute impact of component "b":	$\Delta T(b) = Tb - Ta = a_1 \times (b_1 - b_0) \times c_0 \times d_0$
The absolute impact of component "c":	$\Delta T(a) = Tc - Tb = a_1 \times b_1 \times (c_1 - c_0) \times d_0$
The absolute impact of component "d":	$\Delta T(a) = T_1 - Tc = a_1 \times b_1 \times c_1 \times (d_1 - d_0)$

The relative impact of component "a":	$(\Delta T(a) / \Delta T) \times 100\%$
The relative impact of component "b":	$(\Delta T(b) / \Delta T) \times 100\%$
The relative impact of component "c":	$(\Delta T(c) / \Delta T) \times 100\%$
The relative impact of component "d":	$(\Delta T(d) / \Delta T) \times 100\%$

Appendix 8 continuation

Volkswagen's operating profit per employee component analysis (in millions of euros)

Indicator	2012	2013	2014	2015	2016
T	21.55	20.73	21.76	-6.73	11.47
a	254.75	207.60	217.49	226.40	239.75
b	1.16	1.38	1.31	1.31	1.19
c	1.22	1.22	1.22	1.19	1.23
d	0.06	0.06	0.06	-0.02	0.03

Index	2013/2012	2014/2013	2015/2014	2016/2015
Index of component "a" (Ta/T0) =	0.81	1.05	1.04	1.06
Index of component "b" (Tb/Ta) =	1.19	0.95	1.00	0.91
Index of component "c" (Tc/Tb) =	1.00	1.00	0.97	1.04
Index of component "d" (T1/Tc) =	0.99	1.06	-0.30	-1.71

Impact (ΔT)	2013/2012	2014/2013	2015/2014	2016/2015
Absolute impact of component "a"	-3.99	0.99	0.89	-0.40
Absolute impact of component "b"	3.36	-1.15	0.06	0.67
Absolute impact of component "c"	-0.04	-0.01	-0.58	-0.24
Absolute impact of component "d"	-0.15	1.21	-28.86	18.16
ΔT	-0.83	1.04	-28.49	18.20

Relative impact	2013/2012	2014/2013	2015/2014	2016/2015
(ΔT(a)/ΔT) x 100%	482%	95%	-3%	-2%
(ΔT(b)/ΔT) x 100%	-406%	-111%	0%	4%
(ΔT(c)/ΔT) x 100%	5%	-1%	2%	-1%
(ΔT(d)/ΔT) x 100%	19%	116%	101%	100%
Total	100%	100%	100%	100%

Source: Compiled by the author based on appendices 1 and 2

Appendix 8 continuation

BMW's operating profit per employee component analysis (in millions of euros)

Indicator	2012	2013	2014	2015	2016
T	78.39	72.35	78.38	78.47	75.25
a	376.71	387.91	404.83	409.81	415.21
b	1.54	1.42	1.35	1.48	1.46
c	1.25	1.25	1.27	1.24	1.25
d	0.11	0.10	0.11	0.10	0.10

Index	2013/2012	2014/2013	2015/2014	2016/2015
Index of component "a" (Ta/T0) =	1.03	1.04	1.01	1.01
Index of component "b" (Tb/Ta) =	0.92	0.95	1.10	0.99
Index of component "c" (Tc/Tb) =	1.00	1.01	0.98	1.00
Index of component "d" (T1/Tc) =	0.97	1.08	0.92	0.96

Impact (ΔT)	2013/2012	2014/2013	2015/2014	2016/2015
Absolute impact of component "a"	2.33	3.16	0.97	1.03
Absolute impact of component "b"	-6.21	-3.92	7.77	-1.14
Absolute impact of component "c"	-0.07	0.97	-1.60	0.21
Absolute impact of component "d"	-2.09	5.83	-7.04	-3.32
ΔT	-6.04	6.03	0.09	-3.22

Relative impact	2013/2012	2014/2013	2015/2014	2016/2015
(ΔT(a)/ΔT) x 100%	-39%	52%	1076%	-32%
(ΔT(b)/ΔT) x 100%	103%	-65%	8658%	36%
(ΔT(c)/ΔT) x 100%	1%	16%	-1788%	-6%
(ΔT(d)/ΔT) x 100%	35%	97%	-7846%	103%
Total	100%	100%	100%	100%

Source: Compiled by the author based on appendices 1 and 2

Appendix 9. Comparison matrix

BMW/Volkswagen comparison matrix in 2012–2016

	P	S	C	M	E
S	1				
2016	3.05				
2015	-5.46				
2014	1.81	1			
2013	1.77				
2012	1.81				
C					
2016	3.09	1.01			
2015	-5.71	1.05			
2014	1.88	1.04	1		
2013	1.82	1.03			
2012	3.09	1.01			
M					
2016	3.79	1.24	1.23		
2015	-6.44	1.18	1.13		
2014	1.94	1.07	1.03	1	
2013	1.87	1.05	1.03		
2012	2.46	1.36	1.33		
E					
2016	6.56	2.15	2.13	1.73	
2015	-11.66	2.14	2.04	1.81	
2014	3.60	1.99	1.92	1.86	1
2013	3.49	1.97	1.92	1.87	
2012	3.64	2.01	1.96	1.48	

Source: Compiled by the author based on appendix 7

Appendix 10. Arithmetic and geometric mean of OPEI

Arithmetic and geometric means will be used for ranking the companies by their OPEI (source: compiled by the author based on appendix 9 and formulas 1 and 2 provided in section 2.7). The comparative matrix, BMW on Volkswagen, arithmetic mean of OPEI was calculated as follows:

- 2016 year: $2.60 = \frac{2\ x\ 25.98}{25-5}$
- 2015 year: $-1.99 = \frac{2\ x\ (-19.93)}{25-5}$
- 2014 year: $1.81 = \frac{2\ x\ 18.13}{25-5}$
- 2013 year: $1.78 = \frac{2\ x\ 17.82}{25-5}$
- 2012 year: $1.89 = \frac{2\ x\ 18.92}{25-5}$

The comparative matrix, BMW on Volkswagen, geometric mean of OPEI was calculated as follows:

- $\sqrt[4]{2.60x1.81x1.78x1.89} = 2.00$