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DEPARTMENT OF FINANCE

Assessment of Solvency of a Company in the Automotive Sector

Zhodnocení zadluženosti společnosti v automobilovém průmyslu

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  3. Basic Financial Characteristic of the Selected Company
  4. Analysis of the Solvency of the Selected Company
  5. Conclusion
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List of Abbreviations  
Declaration of Utilisation of Results from the Bachelor Thesis  
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The declaration

“Herewith I declare that I elaborated the entire thesis, including all annexes independently.”

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<b>1. Introduction.....</b>	<b>3</b>
<b>2. Description of the Solvency Assessment Methodology.....</b>	<b>5</b>
2.1 Financial analysis.....	5
2.2 Financial statement.....	6
2.2.1 Balance sheet.....	6
2.2.2 Income statement.....	8
2.2.3 Cash flow statement.....	9
2.3 Common-size analysis.....	10
2.3.1 Vertical common-size analysis.....	11
2.3.2 Horizontal common-size analysis.....	11
2.4 Solvency ratio analysis.....	11
2.4.1 Debt to assets ratio.....	12
2.4.2 Debt to equity ratio.....	15
2.4.3 Interest coverage.....	16
2.4.4 Financial leverage.....	17
2.5 Pyramidal decomposition.....	17
2.5.1 Method of gradual changes.....	18
2.5.2 Logarithmic decomposition method.....	19
2.6 Sensitivity analysis.....	19
2.7 Return on equity.....	20
<b>3. Basic Financial Characteristic of the Selected Company.....</b>	<b>21</b>
3.1 Basic description of Volkswagen Group.....	21
3.1.1 History of Volkswagen Group.....	21
3.1.2 Structure of Volkswagen Group.....	22
3.1.3 Financial position of Volkswagen Group.....	22
3.2 Description of basic data of Volkswagen Group.....	23
3.2.1 The short balance sheet of Volkswagen Group.....	23
3.2.2 The short income statement of Volkswagen Group.....	24
3.3 Common-size analysis of Volkswagen Group.....	25
3.3.1 Vertical common-size analysis of Volkswagen Group.....	26

3.3.2 Horizontal common-size analysis of Volkswagen Group.....	30
<b>4. Analysis of the Solvency of the Selected Company.....</b>	<b>35</b>
4.1 Solvency ratio analysis of Volkswagen Group.....	35
4.1.1 Debt to assets ratio of Volkswagen Group.....	35
4.1.2 Debt to equity ratio of Volkswagen Group.....	38
4.1.3 Interest coverage of Volkswagen Group.....	39
4.1.4 Financial leverage of Volkswagen Group.....	41
4.2 Pyramidal decomposition of solvency ratio of Volkswagen Group.....	43
4.3 Sensitivity analysis of Volkswagen Group.....	51
4.4 Summary of solvency of Volkswagen Group.....	55
<b>5. Conclusion.....</b>	<b>57</b>
<b>Bibliography.....</b>	<b>59</b>
<b>List of Abbreviations.....</b>	<b>61</b>
<b>Declaration of Utilisation of Results from the Bachelor Thesis</b>	
<b>List of Annexes</b>	
<b>Annexes</b>	

## **1. Introduction**

This thesis is focus on the assessment of solvency of Volkswagen Group in the automotive sector. Solvency is based on solvency ratio, it includes debt to assets ratio, debt to equity ratio, interest coverage and so on. Through these ratios, we can measure the solvency of the company. Managers of company can maintain the company's solvency at an appropriate level. The solvency ratio can show the creditors and the investors whether the company can use their cash flow to cover their short-term liabilities and long-term liabilities or not. They are the really important financial indicators for a company.

The aim of this thesis is to make the assessment of solvency of Volkswagen Group by using common-size analysis, solvency ratio analysis, pyramidal decomposition and sensitivity analysis from 2010 to 2014.

This thesis is divided into five parts. The first part is introduction, it is the chapter 1. In this part, we introduce what is the solvency of company, the aim of this thesis and the main content of each chapter.

In chapter 2, we will introduce three basic financial statements: balance sheet, income statement and cash flow statement. And introduce the financial analysis methods which we will use in the next chapter. The first part is the common size analysis. We will use it to check the financial statement of a company. About common size analysis, it has vertical common size analysis and horizontal common size analysis. We will describe what it means and how we can use it in the company. The second part of financial analysis methods is solvency ratios analysis. Solvency ratios are very important for a company. We also write the definition and formula about pyramidal decomposition and sensitivity analysis. And we will introduce the return on equity, because when we make the sensitivity analysis, we will use it.

In chapter 3, we will describe the main financial characteristics of Volkswagen Group. First, we introduce the history and structure of the company, it help us to understand the development of the company. Second part is the financial position. It is the company's ability in the market. And it can help us to know if Volkswagen

Group has financial trouble. At last, we use common size analysis of Volkswagen Group from 2010 to 2014.

In chapter 4, we use solvency ratio analysis. We will use debt to assets ratio, debt to equity ratio, interest coverage and financial leverage to find out the solvency of this company. We also will use pyramidal decomposition in this chapter, we decompose debt to equity ratio into 12 parts. And we use sensitivity analysis of Volkswagen Group. It analyzes which factor will effect the indicator when we have different factors and it's effect degree. When we calculate all the ratios and analysis the methods in this chapter we can know whether the company have financial risks or not and how to manege the company by using these methods.

Chapter 5 is conclusion, in this part, we will compare the analysis we made from 2010 to 2014 and summary all of them. All the methods can help us to know the solvency and the development of Volkswagen Group.



## **2. Description of the Solvency Assessment Methodology**

Solvency of finance or business, is the degree to which the current assets of an individual or entity are more than the current liabilities of that individual or entity. Solvency also can be described as the ability of a company to cover its long-term expenses and to accomplish long-term growth and expansion.

In this chapter, we will describe the methodology of the solvency assessment that will be used in the following chapters. There are seven main parts: financial analysis, financial statements, common-size analysis, solvency ratio analysis, pyramidal decomposition, sensitivity analysis and return on equity.

### **2.1 Financial analysis**

Financial analysis can analyze company's financial status and use the data we get from financial reports. It's the process of evaluating the working capital in the company. The company has to know how to improve the benefits and reduce the risk, that is where the entrepreneur's should pay attention to.

All the company has their own operating mode, first they need to set the goals of the company, then make company goals into key performance indicators. The goals are used to evaluate the operating activities can make benefits or loss. The operating activities of a company includes production, purchase the raw material, acquire or rent the machinery and equipment and so on. The managers of the company manage through the indicators which we get from the analysis, and evaluate if they have trouble in the company. It is prepared by the professional reports by using different ratios, the information is from financial statements and other reports. The reports we have are presented to managers to make decisions. The strengths and weaknesses of the company are expressed by the financial analysis.

We have four methods of financial analysis, and use them to evaluate Volkswagen Group's solvency. The first one is common size analysis, it includes horizontal common-size analysis and vertical common-size analysis. We also use solvency ratio analysis, it includes debt to assets ratio, debt to equity ratio, interest

coverage and financial leverage. The third one is pyramidal decomposition analysis and the last one is sensitivity analysis.

## **2.2 Financial statement**

Financial statement can reflect the financial performance of a company in the past fiscal period, usually quarterly or annual. Financial statement can help investors and creditors to understand the status of the company management, help them to make financial decisions.

Financial statement is mainly composed of three parts: balance sheet, income statement and cash flow statement. When we use solvency ratios, we need to use lots of data from these three statements. Financial statement is very important for a company, because almost all the analysis is based on the data from financial statement. And then the results of those analysis will be helpful for the managers and other related people.

### **2.2.1 Balance sheet**

Balance sheet reflects the company's assets, liability and shareholder's equity, it is a accounting statement, it also is the reflect of the company business activities of static. It can summarize the assets of the company, the value of these assets and the mix of financing used to finance these assets at a given point in time.

Balance sheet is used to correct the mistakes, prevent the errors, determine the direction of management of the company. Not only that, it also can help all the readers in the shortest time to understand the status of the company management.

There are two parts of balance sheet, they are assets, and liabilities and shareholder's equity. The relationship between them is:

$$\text{Assets} = \text{Liabilities} + \text{Shareholder's equity}. \quad (2.1)^1$$

The balance sheet is shown as Tab.2.1

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<sup>1</sup> Source: *Fundamentals of Corporate Finance*. 10<sup>th</sup> ed. McGraw-Hill/Irwin, 2012, page 21.

Tab.2.1 An example of the balance sheet.

<b>Balance sheet</b>	
<b>Assets</b>	<b>Liabilities and shareholder' s equity</b>
Current assets	Current liabilities
Cash and cash equivalents	Commercial paper
Receivables	Accounts payable
Inventories	Accrued liabilities
Prepaid expenses and other	Accrued income taxes
Total current assets	Long-term debt due within one year
Property and equipment,at cost:	Obligations under capital leases due within one
land	<b>Total current liabilities</b>
Buildings and improvements	Long-term debt:
Fixtures and equipment	Long-term obligations under capital leases
Transportation equipment	Deferred income taxes and other
Property and equipment,at cost	Minority interest
Less accumulated depreciation	<b>Shareholders' equity</b>
Property and equipment, net	Preferred stock
Property under capital lease:	Common stock
Property under capital lease	Capital in excess of par value
Less accumulated amortization	Other accumulated comprehensive income
Property and capital lease,net	Retained earnings
Goodwill	Total shareholders' equity
Other assets and deferred changes	<b>Total liabilities and shareholders' equity</b>
<b>Total assets</b>	

Source: *International Financial Statement Analysis*. J. Wiley, 2008, page 9.

The assets of balance sheet including current assets and fixed assets. Current assets are important to businesses because they can be used to fund day-to-day operations and pay ongoing expenses. Current assets refers to the company can convert assets into cash in one year or operating cycle is longer than one year. In a balance sheet, current assets will normally be displayed in order of liquidity, or the ease with which they can be turned in to cash. Current assets include cash and cash equivalents, receivable, inventories and so on. Receivable is bills to buyers that have yet to paid.

A fixed asset is a long-term tangible piece of property that a firm owns and uses in the production of its income and is not expect to be consumed or converted into cash any sooner than at least one year's time. Fixed assets include buildings and

improvements, Less accumulated depreciation and goodwill. Fixed assets has the characteristics of long life and low liquidity.

Liability for a company is corporate debt that must be repaid after a certain period of economy, is the company must fulfill an obligation to do so. Liability will lead outflows of economic benefits in the future, it's the funds of company production and business, except investor's investment, the borrowing from the bank or financial institution are also an important source.

Shareholder's equity is total assets of company minus its total liabilities. It's include the preferred stock, common stock and retained earnings.

### 2.2.2 Income statement

Income statement refers to reflect the operating results of the company for a certain accounting period and the distribution of accounting statements, is the financial records of the company operating performance over a period, reflect the sales revenue of this period of time, cost of sales, management fee and tax status, report the results for the company to achieve profits or losses. We will see the income statement in Tab.2.2

*Tab. 2.2 An example of the income statement.*

<b>Income statement</b>
<b>Revenues</b>
Net sales
Other income,net
<b>Cost and expenses</b>
Cost of sales
Operating,selling,general,and administrative expenses
<b>Operating income</b>
<b>Interest</b>
Debt
Interest income
<b>Provision for income taxes</b>
Current
Deferred
Minority interest
Income from continuing operations
<b>Net income</b>

*Source: International Financial Statement Analysis. J. Wiley, 2008, page 7.*

The relationship between revenues and cost is as the formula:

$$\text{Revenues} - \text{Expenses} = \text{Income} . \quad (2.2)^2$$

The accounting information in the income statement, which can be used to evaluate the management efficiency, operating result of an company, investment value and reward, to measure a firm's success in management, In particular has the following several aspects: the first one is the income statement is the basis of distribution of profits, Income statement reflect the operating income, operating cost, operating expense, and non-operating revenue and so on, finally, we can calculate the profit. The second one is income statement can reflect a lot of aspects of the company, it can help the manager to make to decision. The last one is income statement can be used to analyze the profit ability, predict future cash flow.

### **2.2.3 Cash flow statement**

Cash flow statement reflects the changes of cash of the company in a certain period. In the short term , the cash flow statement can be used to analyze an company has enough cash to cope with overhead or not. Its content is consistent with the balance sheet and income statement. There is a cash flow statement is shown as Tab.2.3

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<sup>2</sup> Source: *Fundamentals of Corporate Finance*. 10th ed. McGraw-Hill/Irwin, 2012., page 24.

Tab. 2.3 An example of the Cash flow statement

<b>Cash flow from operating activities</b>
Income from continuing operations
Depreciation and amortization
Deferred income taxes
Decrease(increase) in accounts receivable
Increase in inventories
<b>Cash flow from investing activities</b>
Payments for property and equipment
Investment in international operations
Net cash used in investing activities
Other investing activities
<b>Cash flow from financing activities</b>
Dividends paid
Income tax paid
Interest paid

Source: *International Financial Statement Analysis*. J. Wiley, 2008, page 11.

There is a very important thing we should know, cash flow statement is not the same as income statement. The principle of these two statement's making is different. Through the cash flow statement, we can know something about the operating activities, investing activities and financing activities of company.

Cash flow from operating activities includes products' selling, service, cash payments for inventories and others. Cash flow from investing activities is including tangible assets and intangible assets. Cash flow from financial activities is including paying out dividends, repay credits, issued stocks and so on.

### 2.3 Common-size analysis

When we want to check the financial statement of a company over time, it will be very difficult to know the changes in relationships because company's account changes over time due to many factors, and these factors are unable to control. In order to solve this problem, we use common-size analysis to get the results.

There are two kinds of common-size analysis, the one is vertical common-size analysis, the other one is horizontal common-size analysis.

### 2.3.1 Vertical common-size analysis

Vertical common-size analysis is the analysis of the changes in the proportions of the items from financial statement. We always use it when we want to know an item on a statement as a percentage of a selected item.

When using this method in balance sheet, we can chose total assets, total equity and total liabilities as the selected item. And in income statement, we chose sales as the benchmark. Calculations is based on the following way:

$$E\% = \frac{X_i}{\sum_n X_i} \cdot 100. \quad (2.3)^3$$

where  $E\%$  is the proportion of the project,  $X_i$  is the items and  $\sum_n X_i$  is the sum of item.

### 2.3.2 Horizontal common-size analysis

Horizontal common-size analysis is the analysis that compare growth in the account in a given period of the company. If there more than two period, we usually chose this method to know the evolution of the financial statement data over times. We will use the data from other years to compare with the data from the based year. The formula is shown as:

$$Percentage\ change = \frac{U_t - U_{t-1}}{U_{t-1}} \cdot 100\% . \quad (2.4)^4$$

$$Absolute\ change = U_t - U_{t-1} . \quad (2.5)^5$$

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<sup>3</sup> Source: *Financial Management and Decision-making of a Company: Analysis, Investing, Valuation, Sensitivity, Risk, Flexibility*. SAEI, vol. 28, 2014, Page 73.

<sup>4</sup> Source: *Financial Management and Decision-making of a Company: Analysis, Investing, Valuation, Sensitivity, Risk, Flexibility*. SAEI, vol. 28, 2014, page 73.

<sup>5</sup> Source: *Financial Management and Decision-making of a Company: Analysis, Investing, Valuation, Sensitivity, Risk, Flexibility*. SAEI, vol. 28, 2014, page 73.

where  $U_t$  is amount of analysis period,  $U_{t-1}$  is amount of previous periods. Usually previous period can be the last year.

## 2.4 Solvency ratio analysis

Solvency ratios is used to measure company's abilities to pay back its debt. Solvency ratios is useful for the investors and creditors, they can know the probabilities to default from these ratios. If the ratios is low, they don't want to borrow money to the company or buy the company's stock.

There are four main kinds of solvency ratios, the first one is debt ratio, the second one is debt to equity ratio, the third one is interest coverage and the last one is financial leverage.

### 2.4.1 Debt to assets ratio

Debt to assets ratio is a financial ratio that measures the extent of a company's or consumer's leverage. It reflects the ability of enterprise to pay the principal and the ability to pay debt interest. It is the ratio of total liabilities to all sources of funding, which shows that the enterprise debt accounted for the proportion of all the money. If the ratio reached 100% or more than 100%, it's means the company have no net assets or insolvent. When calculating, the formula is represented in the following way:

$$\text{Debt to assets ratio} = \frac{\text{total debt (total liabilities)}}{\text{total assets}}. \quad (2.6)^6$$

For different managers the ratio has different expectations. For this reason, the use of this ratio's requirements are different. There are three main users: creditors, investors and companies.

From the view of creditors, what they concerned about is the degree of the safety of the financing and how to receive profits and costs on time. If the capital provided by shareholders in total assets only accounted for a small proportion, creditors will take on more risk, it's a disadvantage for creditors. That is why they hope for the lower debt ratio, the company have enough money to repay the debt, the risk of loans have limited.

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<sup>6</sup> Source: *International Financial Statement Analysis*. J. Wiley, 2008, page 289.



From the view of investors, they are concerned about the capital profit margin is more than the interest rate of the borrowed capital or not. If the capital profit margin is over the interest rates, investors will get more profit. If the interest rates is over the capital profit margin, the profit for investors will reduce. This is a bad news for investors. Because they have to use their profit to repay the interest. So when the capital profit margin is more than the interest rate of borrowed capital, investors hope that the higher debt ratio. When the capital profit margin is less than the interest of borrowed capital, investors hope that the lower debt ratio.

From the view of company, if the debts amount are too large and creditors can't accept it, the financing will become difficult. But higher debt means that the company full of energy. For this reason, the company hope make the debt ratio higher, to expand the scale of production and market, also enhance the vitality of company to get more profits.

And there are some influencing factors of debt ratio. There are profits and NCF, assets and debt.

First is the factor about profits and NCF. When we mention profit, debt to assets ratio was increased, and the profits of this year is higher than the profits of last year. We need according to the growth range of profits and the growth range of debt ratio to know situation is good or bad. If the growth range of profits is greater than the growth range of debt ratio, it have a positive effect for company. Under the circumstance, equity of the company will increase, and then, debt ratio will decrease. If the growth range of debt ratio is greater than the growth of profits, it will be completely opposite. The equity of company will decrease, debt ratio will increase. The other factor is the net cash inflows, when companies have a lot of debt, and have a high profit, in the circumstance, the company will have more cash inflows. This suggests that the company with ability to repay in a certain period. The right of creditors were guaranteed. And at the same time, the business activities of company is a virtuous cycle.

The next factor is assets. When we write this factors, we will divided it into three parts: current assets, long-term investment and fixed assets. First part is current assets,

if current assets accounted for the proportion of total assets of the enterprise is larger, company's capital turnover speed is very high, the liquidity capital which is easy to become cash is in a dominant position. Even if the debt ratio is high also not very terrible. Current assets mainly composed of cash, account receivable, inventory. This assets have the strongest liquidity and abilities to pay. The number of these assets directly affect the company's ability to pay cash. If these three assets account for a large proportion, company current assets structure is reasonable, there is enough cash assets as a guarantee.

Second part about assets is long term investment. Investment is the company through the distribution to increase wealth and get more benefit. If we want to know the investment of the company is reasonable or not, first we need to analysis company's investment accounted for the proportion of total assets is reasonable or not. If there is too much investment, company's investment scale is too large, it will directly affect the company liquidation ability and the ability to pay. Especially in the condition of high debt ratio, it's hard to repay the debt, and affect the reputation of the company. The second, we need to sure the investment project of company is feasible. It means the return on investment must be higher than the financing interest rate.

Third part about assets is fixed assets. The scale of fixed assets is very important for company. There are two major reasons. Fixed assets had better to less than the net assets, fixed assets accounted for two-thirds of net assets is the best situation. Because the company need some current assets to repay debt. If there are too many fixed assets, the company's cash ability will weaken, the ability to repay debt will become poor. And the proportion that how much fixed assets used in production. If fixed assets used in production are too less to produce, it will hard to reach the target for company. Nonproductive fixed assets too much due to fixed assets for production purpose is not enough. In this case, the depreciation will become more, the company's profits and cash inflow decrease lead to the ability of repay debt become weak.

The last factors is debt, it includes short-term debt and long-term debt. Generally, the higher the current ratio, the creditor is guaranteed. But if the current ratio is too high, it will make money stranded on current assets form, affect the

profitability of the company. So the company need to set a reasonable limit for current ratio. Below this line, the debt ratio is likely to be high, the influence of company credit is bad and financing becomes difficult. Above this line, it's hard to make full use of funds.

About short term debt, higher debt ratio show us the more borrowed money from bank, so when company decides to borrow money from bank, they need to analyze the market situation. Through the market environment, economic conditions, economic situation to make the final decision. Good market prospects means debt is feasible, otherwise is unfavorable to borrow. Secondly, they need to make sure profitability after borrowing higher than interest. If the profitability is higher, the company has reason to do that, borrow money from bank. The last step, to analyze current assets and current debt. If current assets more than current debt, it means company has ability to repay debts can guarantee the rights of creditors.

About long term debt, if the company can use those money which has long maturity and high interest very well, that means long-term debt of this company is used in a right way, long-term debt can make more benefit for company. But on the other hand, if the company's business is not smooth, the long-term debt will make financial risk. These can make company have a lot of trouble about debt and risk. It's also an important factor to influence debt ratio. The same as the short-term debt, they need to make sure profitability after borrowing higher than interest. If the profitability is higher, the company has reason to borrow money from bank. Of course, they need to analyze the market situation too.

#### **2.4.2 Debt to equity ratio**

Debt to equity ratio is a debt ratio used to measure a company's financial leverage. Calculated by dividing a company's total liabilities by its stockholders' equity. The ratio indicates how much debt a company is using to finance its assets relative to the amount of value represented in shareholders' equity. The ratio is also known as "risk", "gearing", or "leverage". The two components are often take from the firm's balance sheet or statement of financial position, but the ratio may also be calculate using market values for both. If the company's debt and equity are publicly

trade, or using a combination of book value for debt market value for equity financially. The formula of debt to equity ratio is:

$$\text{Debt to equity} = \frac{\text{total debt (total liabilities)}}{\text{total equity}}. \quad (2.7)^7$$

Creditors and investors are so closely focus on debt to equity ratio, because it shows the extent to which company managers would like to leverage, rather than using self-owned capital. Lenders such as banks are particularly sensitive to this ratio, because excessive this ratio will make them face some risk that the loan will not be repaid. To this risk, banks usually tend to restrict contract, for example, forcing the company with excess cash flow to pay its debts, must using the cash and asking investors to invest more capital. The lower the ratio is, the better company financial situation for a long time creditor's right has been guaranteed. In general, the ratio should be less than one. A lower ratio means greater stability, the risk of the company with higher debt to equity is greater than the company with lower debt to equity ratio.

Different from equity financing, debt must be repaid to the lender. And because of the need to repay the debt and pay interest. So the debt can be as an expensive form of financing. Of course, each industry has different debt to equity ratio benchmarks.

### **2.4.3 Interest coverage ratio**

It's measuring the company's ability to pay debt interest. Calculate by the company's earnings before interest and tax divided by interest expense, its shows the company's ability to pay interest charges. For this reason, creditors need to analyze the interest coverage ratio, in order to measure the safety degree of creditor's rights.

Interest coverage ratio not only reflect the profitability of the company, but also reflects the profitability on the degree of guarantee to pay maturing debt, it is based on the premise of company debt management, is also an important symbol to measure the size of the company long-term solvency. The formula is represented in the following way:

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<sup>7</sup> Source: *International Financial Statement Analysis*. J. Wiley, 2008, page 289.

$$\text{Interest coverage} = \frac{\text{EBIT}}{\text{interest paid}}, \text{ or} \quad (2.8)^8$$

$$\text{Interest coverage} = \frac{\text{operating profit}}{\text{interest paid}}. \quad (2.9)^9$$

If we want to keep normal solvency, interest coverage ratio should be greater than one at least. And the higher the ratio, the stronger long-term ability of repay. If the interest coverage ratio is too low, company will face the risk of loss, decreased the security and stability of the repayment.

#### 2.4.4 Financial leverage

Financial leverage can tell us the company's total assets and the size of investors of the company. The relationship between financial leverage and the company's solvency is the higher financial leverage the company has, the bigger solvency ratio the company will have. Calculation of financial leverage is based on formula:

$$\text{Financial leverage} = \frac{\text{average assets}}{\text{average shareholders' equity}} \quad (2.10)^{10}$$

Financial leverage can tell us how the company use their assets which from their shareholders. We will use this ratio in pyramidal decomposition analysis in chapter 4.

#### 2.5 Pyramidal decomposition

There are lots of methods can be used into pyramidal decomposition analysis. This analysis can help us to analyze the different indicators' influence on the particular indicator, and evaluate the activity and solvency situations. We will

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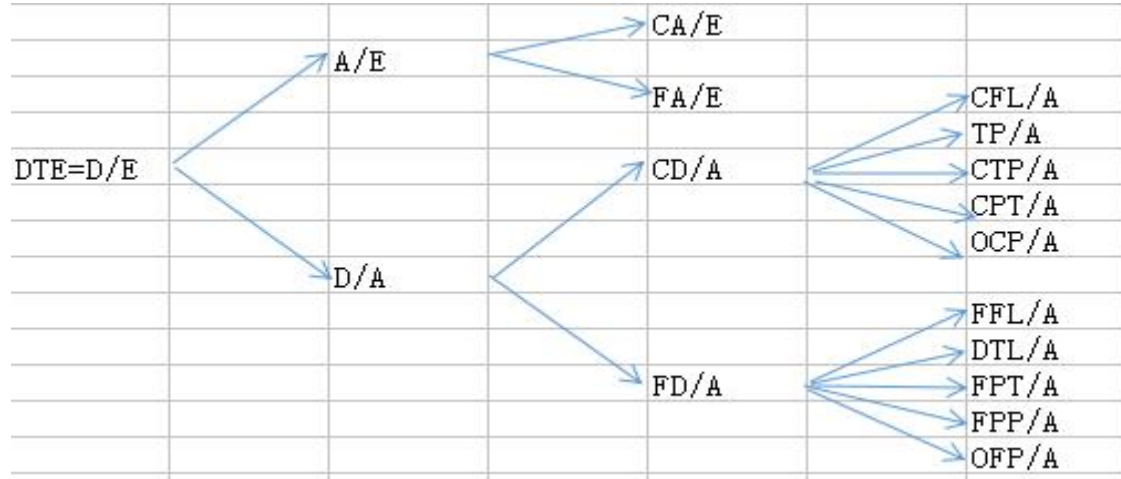
<sup>8</sup> Source: *International Financial Statement Analysis*. J. Wiley, 2008, page 289.

<sup>9</sup> Source: *International Financial Statement Analysis*. J. Wiley, 2008, page 289.

<sup>10</sup> Source: *International Financial Statement Analysis*. J. Wiley, 2008, page 289.

decompose debt to equity ratio in the chapter 4, the debt to equity ratio is decomposed like Image 2.1 shown.

*Image 2.1 Pyramidal decomposition of debt to equity ratio.*



where DTE is debt to equity ratio, CA is current assets, FA is fixed assets, A is total assets, E is total equity, D is total debt, CD is total current debt, and FD is total fixed debt. FFL, DTL, FPT, FPP, OFP, CFL, TP, CTP, CPT and OCP represent fixed financial liabilities, deferred tax liabilities, provision for taxes of fixed portion, provision for pensions of fixed, other fixed provision, current financial liabilities, trade payable, current tax payable, provision for taxes of current portion and other current provision.

We will introduce two methods in this part, they are method of gradual changes and logarithmic decomposition method.

### 2.5.1 Method of gradual changes

The method of gradual changes can quantify the change in the basic ratio because of the change in the component ratio. In the case of decomposition with 3 component ratios calculation based on these formula:

$$\Delta x_{a1} = \Delta a_1 \cdot a_{2,0} \cdot a_{3,0} \cdot \dots \cdot \frac{\Delta y_x}{\Delta x} \quad (2.11)$$

$$\Delta x_{a2} = a_{1,1} \cdot \Delta a_2 \cdot a_{3,0} \cdot \dots \cdot \frac{\Delta y_x}{\Delta x} \quad (2.12)$$

$$\Delta x_{a3} = a_{1,1} \cdot a_{2,1} \cdot \Delta a_3 \cdot \dots \cdot \frac{\Delta y_x}{\Delta x} \quad (2.13)$$

....

$$\Delta x_{a_i} = \prod_{j \leq i} a_{j,0} \cdot \Delta a_i \cdot \prod_{j \geq i} a_{j,1} \cdot \frac{\Delta y_x}{\Delta x} \quad (2.14)^{11}$$

where  $x$  is the basic ratio,  $\frac{\Delta y_x}{\Delta x}$  is the absolute change in the basic ratio,  $a$  is component ratio,  $\Delta a$  is absolute change in the component ratio,  $\Delta x_{a_i}$  is the absolute change of the basic ratio caused by the change of the first ( $a_1$ ) component ratio.

### 2.5.2 Logarithmic decomposition method

About logarithmic decomposition method, we know that this is the method to analyze indicators, the change have caused change in the basic ratio. Impact of the i-th component ratio on the change of the basic ratio is calculates as follow:

$$\Delta x_{a_i} = \frac{\ln I_{a_i}}{\ln I_x} \cdot \Delta y_x. \quad (2.16)^{12}$$

where  $x$  is the basic ratio,  $\Delta y_x$  is the absolute change in the basic ratio,  $I_x = \frac{x_t}{x_0}$  is

the index of change in the basic ratio,  $I_a = \frac{a_t}{a_0}$  is the index of change in component ratio.

### 2.6 Sensitivity analysis

Sensitivity analysis is the point to find out the sensitivity factor that has important influence to investment project's economic benefits index from many uncertain factors. Analysis and measuring the sensitivity degree and influence degree to economic benefit index, and it is an uncertainty analysis project to judge the ability to take risk. Sensitivity analysis is research from the angle of quantitative analysis,

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<sup>11</sup> Source: *Financial Management and Decision-making of a Company: Analysis, Investing, Valuation, Sensitivity, Risk, Flexibility*. SAEI, vol. 28, 2014, page 28.

<sup>12</sup> Source: *Financial Management and Decision-making of a Company: Analysis, Investing, Valuation, Sensitivity, Risk, Flexibility*. SAEI, vol. 28, 2014, page 29.

research some change about relative factors and how it impact one or a set of keys indicators, it is an uncertainty analysis. About sensitivity analysis we always use some indicators like sales revenue, operating costs, production capacity, the initial investment, the life period, construction period to analyze it. The small change of indicators can lead to large variation of the index of the economic, the large change can lead to small variation of index of the economic.

## 2.7 Return on equity

Return on equity of a company can tell us the capital structure of this company. This ratio also tell us the how many profits the company get from every unit of the shareholder's equity. Return on equity is calculated as:

$$ROE = \frac{\text{net income}}{\text{average shareholde r' s equity}} \quad (2.17)^{13}$$

For a company, the higher the return on equity is, the better for the company. Generally, if the ROE of a company is higher than 15%, it is a great level, and if the ROE is higher than 20%, it is the excellent ROE for a company. We will use it in the sensitivity analysis of DTE in chapter 4.

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<sup>13</sup> Source: *Financial Management and Decision-making of a Company: Analysis, Investing, Valuation, Sensitivity, Risk, Flexibility*. SAEI, vol. 28, 2014, page



### **3. Basic Financial characteristics of the Selected Company**

In this chapter, we will write the introduction of Volkswagen Group's financial characteristics. We divided this chapter into three parts, the first one is the basic description of Volkswagen Group, the second one is description of basic data of Volkswagen Group and the last one is common-size analysis of Volkswagen Group.

#### **3.1 Basic description of Volkswagen Group**

In this chapter, we will introduce the basic information of Volkswagen Group, they are history, financial position and structure.

*The Volkswagen Group with its headquarters in Wolfsburg is one of the world's leading automobile manufacturers and the largest car maker in Europe. The Group's goal is to offer attractive, safe and environmentally sound vehicles which can compete in an increasingly tough market and set world standards in their respective class.<sup>14</sup>*

There are twelve brands from seven countries in Europe of Volkswagen Group. All the brands are very famous in the whole world, like SKODA, Bentley, Bugatti and so on. Although these belong to the same company, they have their own characters.

We all know there are lots of car's brand from Volkswagen Group, but the company is not only a car company, but also active in business field and other fields. It is an international and diversification company.

##### **3.1.1 History of Volkswagen Group**

Volkswagen Group was founded on 28 May in 1937 in Berlin. The first well-known brand of this company is Beetle, it is the first successful production of Volkswagen Group.

From 1950 to 1960, this company had a rapidly growth. And in 1965, Volkswagen acquired Auto Union. The new subsidiary go on to produce the first Audi models.

From 1970 to 1992, they used the brand which named "V.A.G", to do the activities which are not included in the car filed, like leasing and distribution. But "V.A.G" is not the official name of Volkswagen Group.

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<sup>14</sup> Source: [www.volkswagenag.com](http://www.volkswagenag.com)

On 30 may 2000, Volkswagen AG turned SKODA Auto into a wholly owned subsidiary company.

### **3.1.2 Structure of Volkswagen Group**

The structure of Volkswagen Group, we divided in two part, the legal structure and organizational structure. First is legal structure, Volkswagen AG is the main company of Volkswagen Group. It is the group that develop vehicles and other equipment of car, but also product and sale cars. Volkswagen financial services and a large number of other company is in Germany and other countries. In more details of it legal structure is that works in electronic industry, the Volkswagen has power to implement these industry. And Volkswagen's board of management is the ultimate institution of managing in this group. The supervisory board , monitors and advises is the directly decision part of company.

Second is organizational structure of the group, the Volkswagen group is famous in the world ,so its the important group to lead the automotive product. The operation of the company has automobile and financial service. It has a big range of development, different business activities of the companies in Volkswagen Group makes different product and operation. For these years development, Volkswagen Group make sales in Western Europe, China, Brazil, the USA, Russia and Mexico. The commercial segment is offer more service in Volkswagen Group.

### **3.1.3 Financial position of Volkswagen Group**

Financial management of Volkswagen Group includes liquidity management, products risk management and credit risk management. It is operated by Group Treasury and based on the internal directives and risk parameters.

About liquidity management, the aim of Volkswagen Group is to ensure the ability of solvency and make an adequate return from the investment. The material companies of Volkswagen Group using cash pooling to optimize the use of liquidity, which enables the balance accumulations on cash pooling.

In addition, interest rate and currency is also useful to hedge the price. And derivative financial instruments are essential to investment and production plans. They could influence the financial position of Volkswagen Group.

Credit and risk management are others important elements of Volkswagen Group's financial. It helps company to avoid the risk of loss or default. In order to achieve this target, Volkswagen Group sets up independent institution to limit the volume of business when entering financial transactions.

### **3.2 Description of basic data of Volkswagen Group.**

In this part, we will describe the basic data of Volkswagen Group which will be used in common-size analysis and solvency ratio analysis. The time of these data is from 2010 to 2014. Because we don't use the data from cash flow statement, so we just make the short balance sheet and short income statement. The short balance sheet of Volkswagen Group is shown in Tab.3.1 and the short income statement of Volkswagen statement is shown in Tab.3.2.

#### **3.2.1 The short balance sheet of Volkswagen Group.**

The balance sheet which we have used are from Volkswagen Group's financial annual reports from 2010 to 2014. Because we don't need the whole balance sheet, so we simplified the balance sheet which are shown in Tab.3.1.

Tab.3.1 Short balance sheet of Volkswagen Group from 2010 to 2014. (Millions Euro)

	2010	2011	2012	2013	2014
<b>Non-current assets</b>	<b>113456</b>	<b>147987</b>	<b>196582</b>	<b>202142</b>	<b>220106</b>
<b>Current assets</b>	<b>85936</b>	<b>105640</b>	<b>113062</b>	<b>122192</b>	<b>131103</b>
Inventories	17631	27551	28674	28653	31466
Trade receivables	6883	10479	10099	11133	11472
Financial services receivables	30164	33754	36911	38386	44398
Other receivables and financial assets	6605	8796	10695	11621	12773
Current tax receivables	482	623	761	729	1010
Marketable securities	5501	6146	7433	8492	10861
Cash, cash equivalents and time deposits	18670	18291	18489	23178	19123
<b>Total assets</b>	<b>199392</b>	<b>253627</b>	<b>309644</b>	<b>324334</b>	<b>351209</b>
<b>Shareholder's equity</b>	<b>48712</b>	<b>63354</b>	<b>81825</b>	<b>90037</b>	<b>90189</b>
<b>Non-current liabilities</b>	<b>73781</b>	<b>89216</b>	<b>122306</b>	<b>115672</b>	<b>130314</b>
<b>Current liabilities</b>	<b>76899</b>	<b>101057</b>	<b>105513</b>	<b>118625</b>	<b>130706</b>
Current financial liabilities	39852	49090	54060	59987	65564
Trade payable	12544	16326	17268	18024	19530
Current tax payable	286	844	238	218	256
Other current liabilities	10627	16097	15537	19167	25490
Provision for taxes	2077	2888	1721	2869	2791
Other current provision	11513	15812	16689	18360	17075
<b>Total liabilities</b>	<b>150680</b>	<b>190273</b>	<b>227819</b>	<b>234297</b>	<b>261020</b>
<b>Total liabilities and equity</b>	<b>199392</b>	<b>253627</b>	<b>309644</b>	<b>324334</b>	<b>351209</b>

Source: Volkswagen Group annual report from 2010 to 2014.

### 3.2.2 The short income statement of Volkswagen Group.

When we make solvency ratio analysis, we will use data from income statement, so we simplified the income statement of Volkswagen Group from 2010 to 2014

based on basic income statement which we have written in chapter 2. The short income statement is presented as Tab.3.2.

*Tab.3.2 Short income statement of Volkswagen Group (Millions Euro)*

	2010	2011	2012	2013	2014
Sales revenue	126875	159337	192676	197007	202458
Cost of sales	-105431	-131371	-157518	-161407	-165934
Gross profit	<b>21444</b>	<b>27966</b>	<b>35158</b>	<b>35600</b>	<b>36524</b>
Distribution expenses	-12213	-14582	-18850	-19655	-20292
Administrative expenses	-3287	-4384	-6223	-6888	-6841
Other operating income	7648	9727	10496	9956	10298
Other operating expenses	-6450	-7456	-9070	-7343	-6992
<b>Operating profit</b>	7142	11271	11511	11670	12697
Financial income	3997	9702	16535	3123	4755
<b>EBIT</b>	11139	20973	28046	14793	17452
Interest	-2144	-2047	-2552	-2366	-2658
<b>EBT</b>	8995	18926	25494	12427	14794
Taxation	-1767	-3126	-3608	-3284	-3726
<b>EAT</b>	7228	15800	21886	9143	11068

*Source: Volkswagen Group annual report from 2010 to 2014.*

### **3.3 Common-size analysis of Volkswagen Group**

In this part, we will describe Volkswagen Group by using common-size analysis. This analysis can be divided into two parts, the one is vertical common-size analysis, another is horizontal analysis. The data used in common-size analysis are from Volkswagen Group annual report from 2010 to 2014. And in this part, we have to mention two important things of Volkswagen Group from 2010 to 2014. The first one is the Volkswagen Group acquired the Porsche Group in 2012, the second one is the Volkswagen Group increase the dividend in 2013. After Volkswagen Group acquired the Porsche Group, their non-current liabilities will be decreased sharply, because they use their non-current liabilities to acquire the Porsche Group. And before 2012,

Volkswagen Group has prepared the non-current liabilities which used to buy the Porsche Group already, that is the reason why the non-current liabilities of Volkswagen Group was increased before 2012. In 2013, the Volkswagen Group increase the dividend per share, the dividend's increasing will effect the assets and shareholder's equity, we will write about them later.

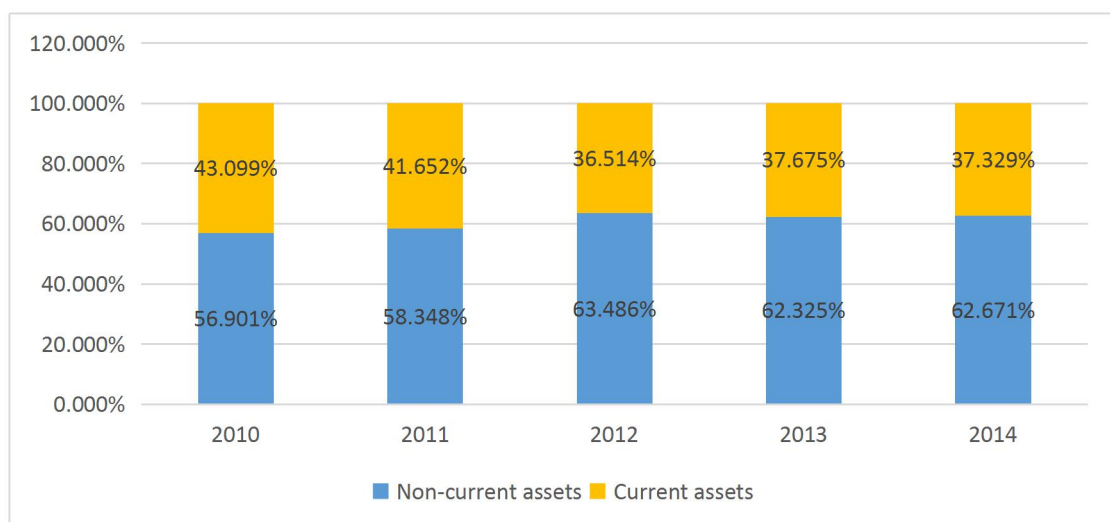
### 3.3.1 Vertical common-size analysis of Volkswagen Group

This part is the vertical common-size analysis of Volkswagen Group. Vertical common-size analysis is the analysis of the changes in the proportions of the items from financial statement. So we will calculate the proportion of each item in total assets. Results of calculation is shown in Tab.3.3. The percentage changes are expressed in Chart 3.1.

Tab. 3.3 The proportion of each item in total assets (%)

	2010	2011	2012	2013	2014
Non-current assets	56.901	58.348	63.486	62.325	62.671
Current assets	43.099	41.652	36.514	37.675	37.329
Total assets	100.00	100.00	100.00	100.00	100.00

Chart 3.1 Vertical common-size analysis of assets.



From Tab.3.3 and Chart 3.1, we can see the structure of total assets during this five years. Total assets include current assets and non-currents assets. In these five years, the change of the number is not very big, and the difference between current assets and non-current assets is not very big. It means the company's situation about

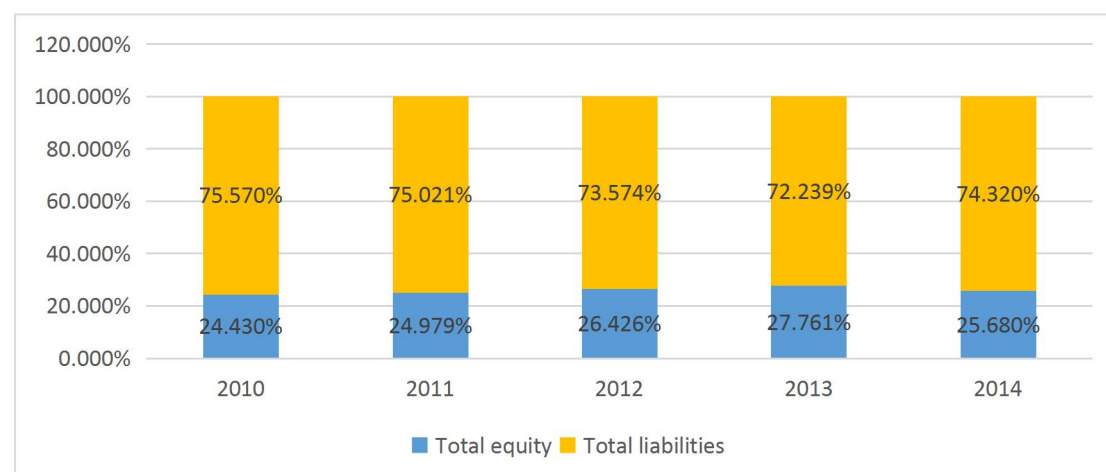
financial is very good and stable. The proportion of non-current assets of company increased every year. In this case, the current assets is less than the non-current assets, so the liquidity of company was limited, because it's difficult for the company to convert the assets into cash. Anyhow, the company's tendency of current assets was stabled from 2012 to 2014, it's a good news for the company.

Then we will calculate the proportion of each item in total equity and liabilities, the presented results of calculation is shown as Tab.3.4 and the percentage changes are expressed in Chart 3.2.

*Tab. 3.4 The proportion of each item in total equity and liabilities (%).*

	2010	2011	2012	2013	2014
<b>Shareholder's equity</b>	24.430	24.979	26.426	27.761	25.680
<b>Total liabilities</b>	75.570	75.021	73.574	72.239	74.320
Non-current liabilities	37.003	35.176	39.499	35.665	37.104
Current liabilities	38.567	39.845	34.076	36.575	37.216
<b>Total liabilities and equity</b>	100.000	100.000	100.000	100.000	100.000

*Chart 3.2 Vertical common-size analysis of equity and liabilities.*



In Tab.3.4 we can know the proportion of total equity is increased every year but 2014. So total liabilities were decreased every year but 2014, because the proportion of total equity and liabilities is fixed. And because total liabilities have two parts, long-term liabilities and current liabilities. When long-term liabilities were increased, current liabilities would be decreased. In a generally way, when the proportion of

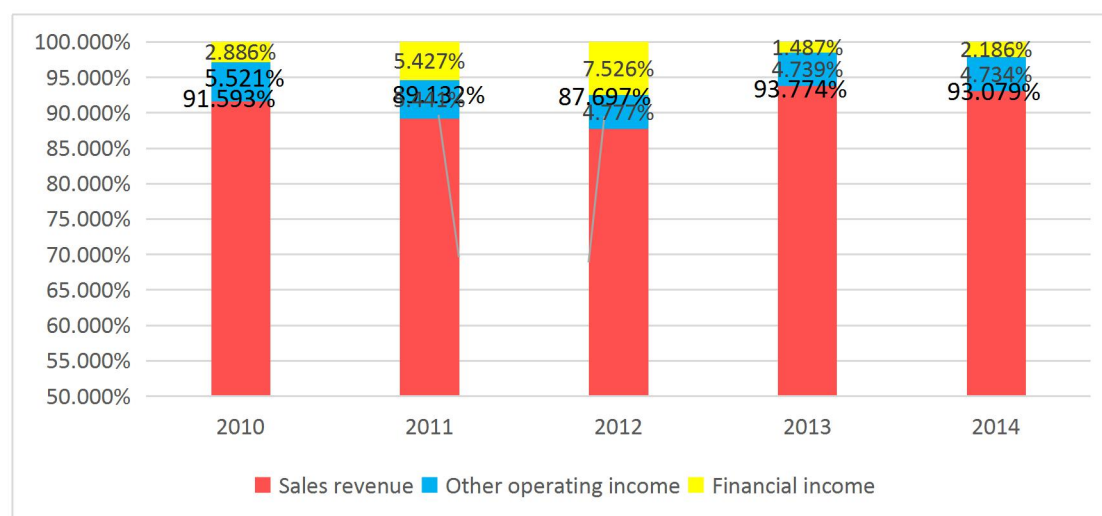
liability is more than 45%, the financial situation is very well. The higher proportion of liabilities means a larger proportion of capital were used in production. Of course, the risk exists. Although the proportion of liability is increased in 2014, we still think the status of the company is very good.

Next we will calculate the proportion of each items from income statement in revenues, the results is shown as Tab.3.5, and the percentage changes are shown in Chart 3.3.

Tab. 3.5 The proportion of each item in revenues (%).

	2010	2011	2012	2013	2014
Sales revenue	91.593	89.132	87.697	93.774	93.079
Other operating income	5.521	5.441	4.777	4.739	4.734
Financial income	2.886	5.427	7.526	1.487	2.186
Total revenues	100.000	100.000	100.000	100.000	100.000

Chart 3.3 Vertical common-size analysis of revenues.



We can see the structure of company's revenue. It includes sales revenues, other operating income and financial income. Sales revenue had the highest proportion of total revenue. It always more than 87%, but the proportion of sales revenue had fluctuation changes. We can get the range of that from chart 3.3, the range is from 87.7% t 93.77%. And in 2012, it reached the lowest point which was 87.70%, and then it reached the highest point which was 93.77%. It's not a big difference, so investors can understand that Volkswagen group have a a good financial situation and



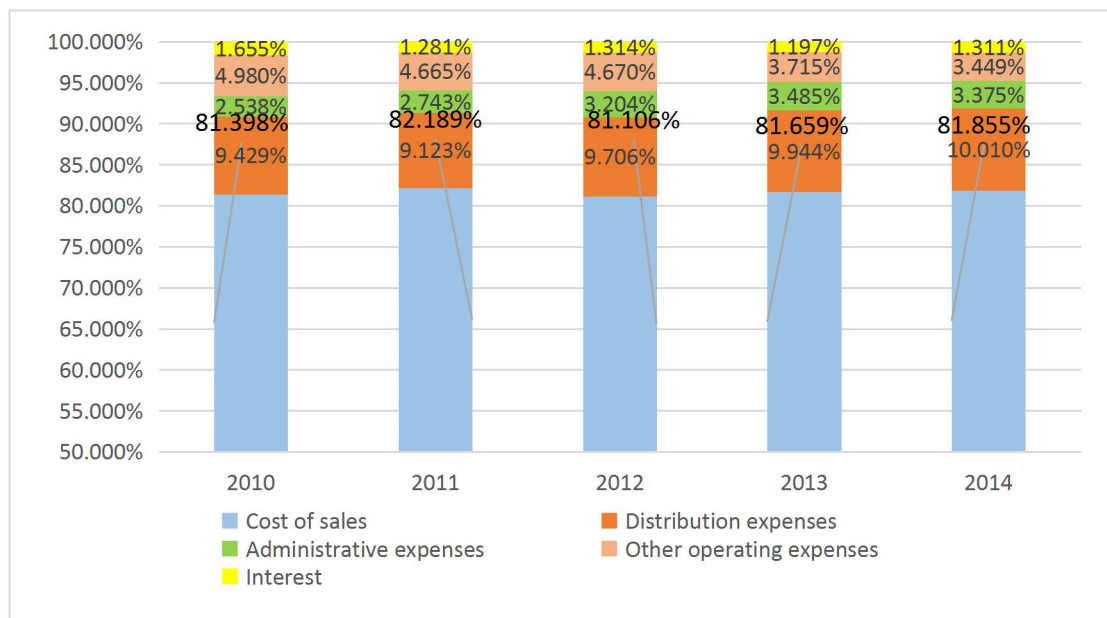
stable status. And the proportion of other operating income is very stable, the fluctuation's range is narrow. In this case, the financial income must have an opposite situation with sales revenues. But all of them are percentage, we can't say the sales revenues increase or decrease, it will be depend on the actual number.

Then we will calculate the proportion of each item in expenses, the results is presented in Tab.3.6 and the percentage changes are shown in Chart 3.4.

Tab. 3.6 The proportion of each item in expenses (%).

	2010	2011	2012	2013	2014
Cost of sales	81.398	82.189	81.106	81.659	81.855
Distribution expenses	9.429	9.123	9.706	9.944	10.010
Administrative expenses	2.538	2.743	3.204	3.485	3.375
Other operating expenses	4.980	4.665	4.670	3.715	3.449
Interest	1.655	1.281	1.314	1.197	1.311
<b>Total expenses</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>

Chart 3.4 Vertical common-size analysis of expenses.



We can know the situation of expenses of Volkswagen Group. Their expenses are made up of five parts. The first one is cost sales, it's the largest part, and very stable. The fluctuation is very narrow. It reached the highest point in 2011, it is 82.189%. The second one is distribution expense, it's stable too. The difference of the top and button point is 0.83%. The third one is administrative expense. The range of

fluctuation of this is from 2.54% to 3.48%. It is a very narrow range. And the rest of them are other operating expenses and interest. All of them have the same characteristic. It means Volkswagen Group can control their costs of production, sales, administrative and so on in a stable fluctuation. Such company, there will be a nice prospect and a good financial statement.

### **3.3.2 Horizontal common-size analysis of Volkswagen Group.**

In this part we will describe horizontal common-size analysis of Volkswagen Group by comparing each item between two years. We will calculate the absolute change in balance sheet. Results are presented in Tab.3.7. Calculation is based on Tab.3.1 and formula (2.5). We also will calculate percentage change in balance sheet between two years. Results are presented in Tab.3.8, calculation is based on Tab.3.1 and formula (2.4). And the horizontal common-size analysis of balance sheet is showed in Chart 3.5.

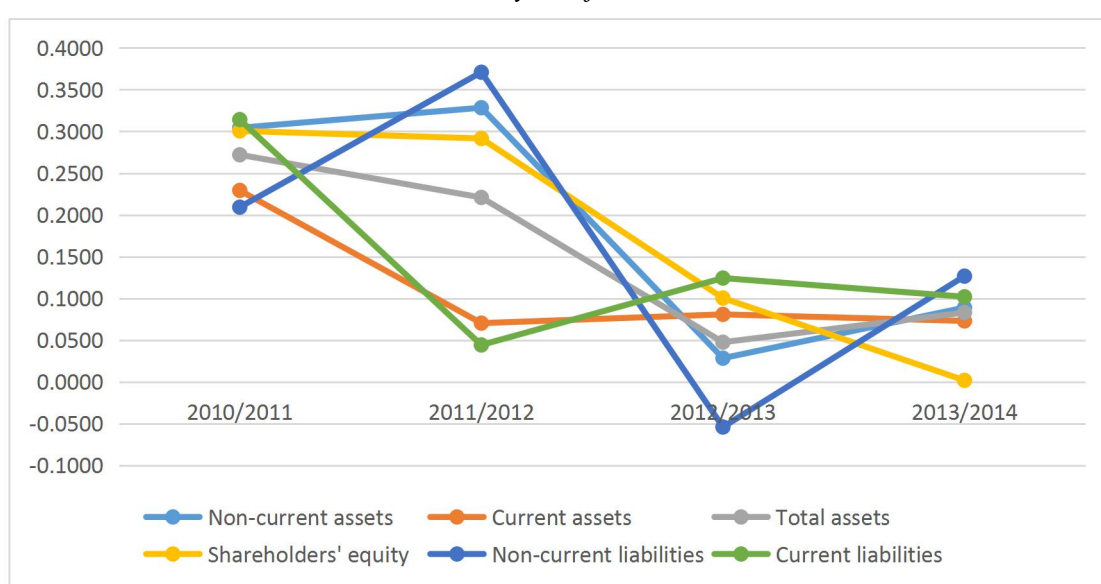
*Tab.3.7 Absolute change of each item in balance sheet (1000 Euro).*

	2010/2011	2011/2012	2012/2013	2013/2014
Non-current assets	34531	48595	5560	17964
Current assets	19704	7422	9130	8911
Total assets	54235	56017	14690	26875
Shareholders' equity	14642	18471	8212	152
Non-current liabilities	15435	33090	-6634	14642
Current liabilities	24158	4456	13112	12081

Tab.3.8 Percentage change of each item in balance sheet (%).

	2010/2011	2011/2012	2012/2013	2013/2014
Non-current assets	0.3044	0.3284	0.0283	0.0889
Current assets	0.2293	0.0703	0.0808	0.0729
Total assets	0.2720	0.2209	0.0474	0.0829
Shareholders' equity	0.3006	0.2916	0.1004	0.0017
Non-current liabilities	0.2092	0.3709	-0.0542	0.1266
Current liabilities	0.3142	0.0441	0.1243	0.1018

Chart 3.5 Horizontal common-size analysis of balance sheet.



From Tab.3.7 and Tab.3.8, we can see the volatility of company's capital from 2010/2011 to 2013/2014. There are six kinds of data, non-current assets, current assets, total assets, Shareholder's equity, non-current liabilities and current liabilities.

From fiscal year 2010 to fiscal year 2012, non-current assets and non-current liabilities had a lots of growth, especially the non-current liabilities, it had a particularly sharp growth. It is because the company is going to expand its factories and cooperated with other car companies in 2012. In that year, Volkswagen Group acquired Porsche Group, so they needed more lands, buildings and equipment. The company needed to borrow more capital to meet the development of the company. And the increasing range of the rest data have different degree of reduced, especially current assets and current liabilities. It is because after Volkswagen Group acquiring

Porsche Group, they need to make the debt level back to a normal condition just like before. So they reduce their current liabilities and current assets, that cause the decreasing of the solvency of Volkswagen Group. Because their increasing current assets was decrease, if they want to converted the assets to cash will be more difficult. Current assets is increasing from 2010 to 2014. It means the company had good ability to pay off its short-term liabilities.

Equity increased a lot from 2011 to 2012, but increased less and less after 2012. And total assets increased less and less. As we have written before, in 2013, Volkswagen Group increase their dividend in order to return to their shareholders, but this move didn't help Volkswagen Group to get more shareholder's equity in 2014, so Volkswagen Group should attract more investors to put the investment in their company and let more shareholders to buy their shares.

We also will make horizontal common-size analysis of income statement, the results of absolute change in consolidated income statement are shown in Tab.3.9. The calculation is based on Tab.3.2 and formula (2.5). The results of percentage change in income statement between two given different periods are presented in Tab.3.10. For calculation, we will use Tab.3.2 and formula (2.4). And horizontal common-size analysis of income statement is shown in Chart 3.6.

*Tab.3.9 Absolute change of each item in income statement (millions Euro).*

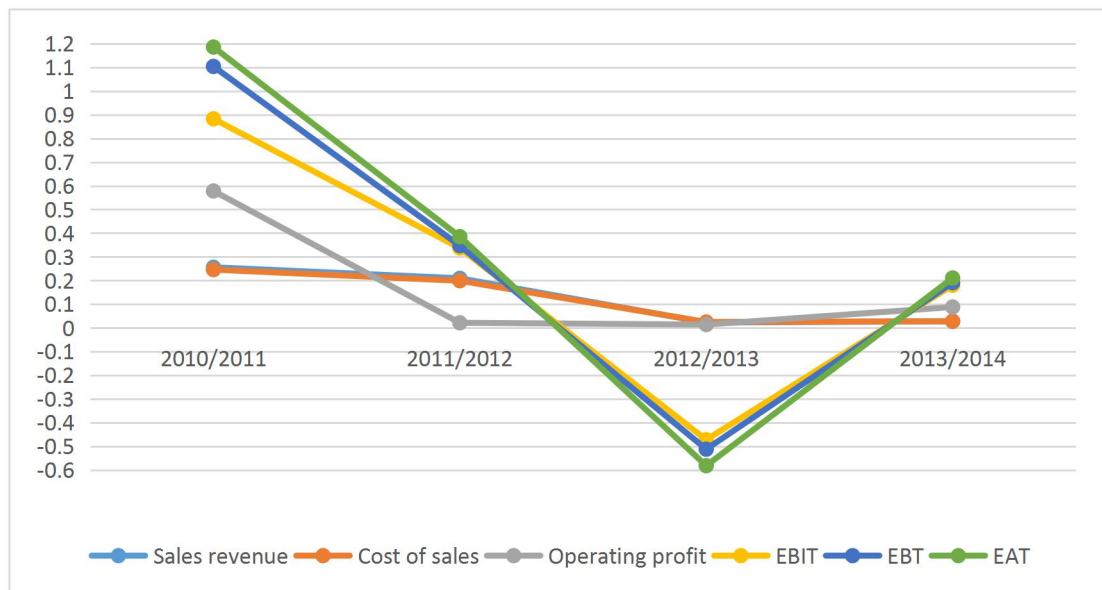
	2010/2011	2011/2012	2012/2013	2013/2014
Sales revenue	32462	33339	4331	5451
Cost of sales	-25940	-26147	-3889	-4527
Gross profit	6522	7192	442	924
Distribution expenses	-2369	-4268	-805	-637
Administrative expenses	-1097	-1839	-665	47
Other operating income	2079	769	-540	342
Other operating expenses	-1006	-1614	1727	351
<b>Operating profit</b>	4129	240	159	1027
Financial income	5705	6833	-13412	1632

<b>EBIT</b>	9834	7073	-13253	2659
Interest	97	-505	186	-292
<b>EBT</b>	9931	6568	-13067	2367
Taxation	-1359	-482	324	-442
<b>EAT</b>	8572	6086	-12743	1925

*Tab.3.10 Percentage change of each item in income statement (%).*

	2010/2011	2011/2012	2012/2013	2013/2014
Sales revenue	0.2559	0.2092	0.0225	0.0277
Cost of sales	0.2460	0.1990	0.0247	0.0280
Gross profit	0.3041	0.2572	0.0126	0.0260
Distribution expenses	0.1940	0.2927	0.0427	0.0324
Administrative expenses	0.3337	0.4195	0.1069	-0.0068
Other operating income	0.2718	0.0791	-0.0514	0.0344
Other operating expenses	0.1560	0.2165	-0.1904	-0.0478
<b>Operating profit</b>	0.5781	0.0213	0.0138	0.0880
Financial income	1.4273	0.7043	-0.8111	0.5226
<b>EBIT</b>	0.8828	0.3372	-0.4725	0.1797
Interest	-0.0452	0.2467	-0.0729	0.1234
<b>EBT</b>	1.1041	0.3470	-0.5126	0.1905
Taxation	0.7691	0.1542	-0.0898	0.1346
<b>EAT</b>	1.1859	0.3852	-0.5822	0.2105

Chart 3.6 Horizontal common-size analysis of income statement.



From this chart, we can understand the situation of income of the Volkswagen Group. Sales revenues increased all the time. It is a good sign for company. But from 2012 to 2014, it only increased a little comparing to previous years. It means the company did not sale so many produces. The cost of sales was increasing from 2010 to 2014. It is because scale economy. Volkswagen Group has less cost with the development of technology. EBIT decreased 13251 millions of euros from 2012 to 2013. It is mainly due to the company lost some investment and had less long-term liabilities. Interest decreased 505 millions of euros in 2012 and 292 millions of euros in 2014. It is because the company had less debt to maintain the operation of company. Taxation only increased in 2013 but decreased in other years. In 2011, taxation decreased 1359 millions of euros. It is because the company produced less automobiles.

We can see EAT of Volkswagen Group was decreased in 2013, the reason is that in 2012, Volkswagen Group has acquired Porsche Group, so they increase their liabilities, that move cause the financing cost of Volkswagen Group is rose up, the results is the revenues of this company was decreased a little. And in 2013, this company increase the dividend of the shares, so the capital cost was increased as well, the end result is the net profits of Volkswagen Group in 2013 is decreased. That is the reason why EAT in the fiscal year 2012/2013 is negative.

## 4. Analysis of the Solvency of the Selected Company

In this chapter, we will make analysis of solvency of Volkswagen Group. We will use the methods which we have written in chapter 2, so we divide this chapter into four parts. The first part is solvency ratio analysis of Volkswagen Group, the second one is pyramidal decomposition analysis of Volkswagen Group, the third one is sensitivity analysis of Volkswagen Group, the last part is the summary of the results from these three methods.

### 4.1 Solvency ratio analysis of Volkswagen Group.

There are lots kinds of ratios can be used to make analysis of a company's financial position, we chose solvency ratios to analyze Volkswagen Group's Solvency. Solvency ratio including debt to assets ratio, debt to equity ratio, financial leverage and interest coverage, so this section is divided into four parts.

And in order to know whether the solvency of Volkswagen Group is good or not, we chose two companies to make the comparison. These two company are also very famous in the automotive industry, they are Daimler AG and BMW Group.

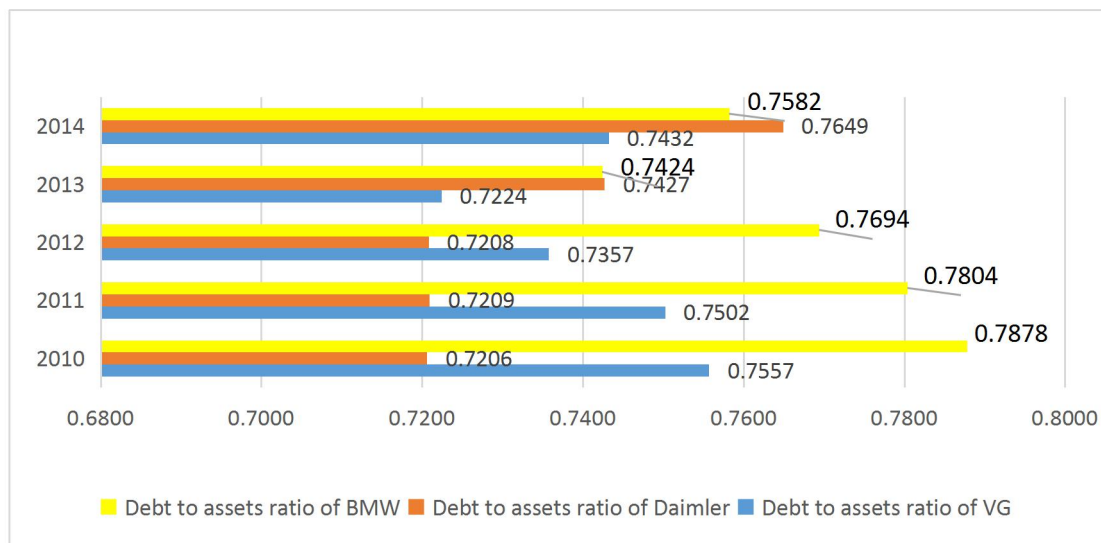
#### 4.1.1 Debt to assets ratio of Volkswagen Group.

At first, we will calculate debt to assets ratio of Volkswagen Group in order to see the ability of this company to pay the principal and the debt interest. We also calculate debt to assets ratio of Daimler AG and BMW Group to make the comparison. Results from 2010 to 2014 are shown in Tab.4.1 and the comparison of debt to assets ratio of these three company is shown in Chart 4.1.

*Tab.4.1 Debt ratio of Volkswagen Group, Daimler AG and BMW Group.*

	2010	2011	2012	2013	2014
Debt to assets ratio of VG	0.7557	0.7502	0.7357	0.7224	0.7432
Debt to assets ratio of Daimler	0.7206	0.7209	0.7208	0.7427	0.7649
Debt to assets ratio of BMW	0.7878	0.7804	0.7694	0.7424	0.7582

Chart 4.1 Comparison of debt to assets ratio of VG, Daimler and BMW



Calculation is based on formula (2.6), we need to know total liabilities and total assets of Volkswagen Group. As what we have written in chapter 2, the company always hope debt to assets ratio can be high. Because the higher the debt to assets ratio of the company is, the larger profit the company can get. And from Tab.4.1 we can see debt to assets ratio of Volkswagen Group from 2010 to 2014 is around 0.74. The highest debt to assets ratio of Volkswagen Group is in 2010, it is 0.7557 and the lowest is in 2013, it is 0.7224. The reason why the debt to assets ratio is lowest in 2013 is because Volkswagen Group increased their dividend in 2013, that causes the assets and shareholder's equity was increased, at the same time, Volkswagen Group decreased their liabilities in order to have a normal debt level, total liabilities was decreased, so debt to assets ratio was decreased in 2013. So we can say that Volkswagen Group has the best ability to pay the interest and capital in 2013. And because we use debt to assets ratio to analyze the solvency of a company, so in other way, we can say the solvency of Volkswagen Group in 2013 is the best.

The ideal debt to assets ratio of a company is supported to be from 0.4 to 0.6. However debt to assets ratio of Volkswagen Group in the past five years all are higher than the ideal ratio. That means Volkswagen Group has more money to running their business, and the source of funding is increased. That is the advantage of the higher debt to assets ratio, but it also has two disadvantages. The first one is the cost of capital is increased, Volkswagen Group need to pay more interest of the debt, the



second one is they need to face a larger financial risk than the company who has lower debt ratio.

Although debt to assets ratio of Volkswagen Group are higher than the ideal range, but they keep it in a stable level, around 0.73. The reason is Volkswagen Group is a international company who was established in 1937, they has good management and can use the capital which is from the shareholders in proper ways. So they can keep their liabilities and assets in a stable range to make a stable debt ratio. But their can not control how much capital they will get in a special number, so debt to assets ratio will be different in every year.

And we can see the development trend of debt to assets ratio of BMW is the same with the Volkswagen Group. we can see debt to assets ratio of BMW from 2010 to 2014 is around 0.77, the highest debt to assets ratio of BMW is in 2010 and the lowest is in 2013, it is 0.7424. Despite their development trend are the same, but amount of them are different. So BMW has the best ability to pay the interest and capital in 2013 , the solvency of BMW in 2013 is the best. Compared with the Volkswagen Group, BMW had more debt to assets ratio every year. So although BMW had stronger profitability, but the Volkswagen's solvency are better than BMW.

The third company is Daimler, different from the Volkswagen Group and BMW, from 2010 to 2013, debt to assets ratio of Daimler was very stable around 0.72, and then debt to assets ratio of Daimler was increase sharply from 2013 to 2014. Because they want to get more profit, so they increased the debt. Higher debt to assets ratio means higher profitability and more risk. Compared with Volkswagen, according to the debt ratio. From 2010 to 2012, the debt to assets ratio of Volkswagen is higher than Daimler, and from 2013 to 2014, the Daimler's debt to assets ratio exceeded Volkswagen Group. So we can say Daimler had better solvency than Volkswagen's solvency from 2010 to 2012, and Volkswagen had better solvency than Daimler.

In a word, regardless of profitability, from 2010 to 2012, BMW's solvency is strongest, and from 2013 to 2014, Daimler's solvency is strongest.

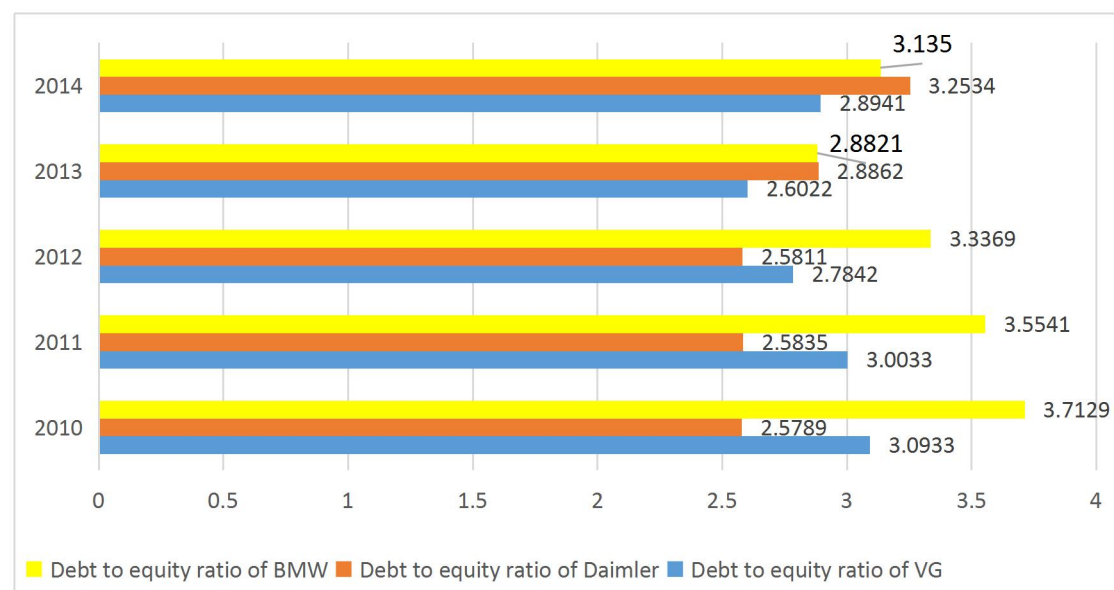
#### 4.1.2 Debt to equity ratio of Volkswagen Group.

Secondly, we will calculate debt to equity ratio to see how much debt Volkswagen Group is using to finance its assets relative to the amount of value represented in shareholders' equity. We also calculate this ratio of Daimler AG and BMW Group for comparison. The results are presented as Tab.4.2 and comparison of this ratio is shown as Chart 4.2.

Tab.4.2 Debt to equity ratio of Volkswagen Group, Daimler AG and BMW Group.

	2010	2011	2012	2013	2014
Debt to equity ratio of VG	3.0933	3.0033	2.7842	2.6022	2.8941
Debt to equity ratio of Daimler	2.5789	2.5835	2.5811	2.8862	3.2534
Debt to equity ratio of BMW	3.7129	3.5541	3.3369	2.8821	3.1350

Chart 4.2 Comparison of debt to equity ratio of VG, Daimler and BMW.



Calculation is based on formula (2.7). From chart 4.2 we can see the situation of these three company's debt to equity ratio, we can see the tendency of the debt to equity ratio of these three companies are the same with the tendency of debt to assets ratio of these three companies. The lower the ratio, the better company financial situation for a long term creditor's right has been guaranteed. Calculation is based on formula (2.9), we need to know total liabilities and total equity of these three companies.

In general, debt to equity ratio should less than 1, but all of these companies, their debt to equity ratio are more than 1, and even up to 3. This is because the company's scale is large enough to have a good reputation, easy for financing, credit risk is low. They can afford such a high debt to equity ratio.

From Chart 4.2, we can see that debt to equity ratio of BMW is greater than debt to equity ratio of Volkswagen Group in the past five years, so we can say that the solvency ability of Volkswagen Group is stronger than BMW. Although BMW's solvency ability is not very well, it is still a competitive company. However, comparing with Daimler, only in 2013 and 2014, the solvency ability of Volkswagen Group is better than Daimler, it means from 2010 to 2012, Volkswagen Group's solvency ability is in middle of the industry. We can see in 2013, debt to equity ratio of Volkswagen Group is the lowest, it is 2.6022. The reason is like what we have written before, the dividend was increased, that attract more shareholders to buy Volkswagen Group's shares, so the equity was increased too. The equity was increased and liabilities not change a lot, so debt to equity ratio was decreased in 2013. And in 2014, debt to equity ratio was increased, it is because after the acquiring, Volkswagen Group has decreased the liabilities, and equity didn't have lots of difference, so debt to equity ratio increased in 2014. Anyway, in 2013 and 2014, the solvency ability of Volkswagen Group in the best in these three companies.

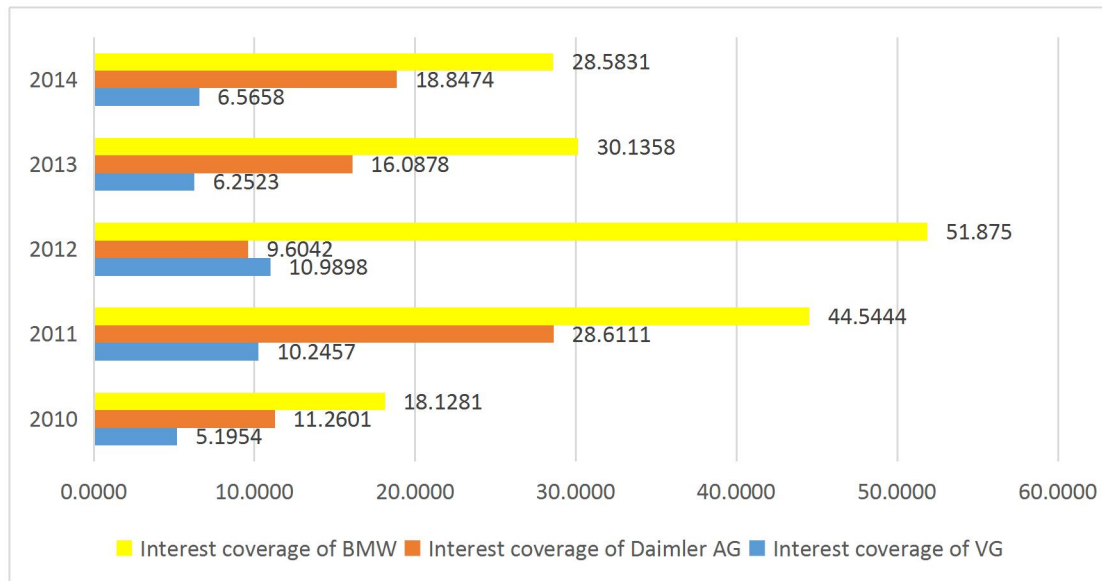
#### **4.1.3 Interest coverage of Volkswagen Group.**

Thirdly, we will calculate interest coverage of Volkswagen Group to measuring the company's ability to pay debt interest. As the same as other three ratios, we will calculate this ratio of the other two companies to make comparison with Volkswagen Group. Results are shown in Tab.4.4 and comparison of interest coverage is shown in Chart 4.4.

Tab.4.4 Interest coverage of Volkswagen Group , Daimler AG and BMW Group.

	2010	2011	2012	2013	2014
Interest coverage of VG	5.1954	10.2457	10.9898	6.2523	6.5658
Interest coverage of Daimler	11.2601	28.6111	9.6042	16.0878	18.8474
Interest coverage of BMW	18.1281	44.5444	51.8750	30.1358	28.5831

Chart 4.4 Comparison of interest coverage of VG, Daimler and BMW.



Calculation is based on formula (2.8). We need to know EBIT and interest. It's measuring the company's ability to pay debt interest. The higher interest coverage means that company is easy to pay for interest charges. For this reason, creditors need to analyze the interest coverage ratio, in order to measure the safety degree of creditor's right.

So we can understand something from chart 4.4. In every year, BMW had the highest interest coverage, and the interest coverage of Volkswagen was worst. In this way, the result is different from debt to assets ratio, debt to equity ratio and financial leverage. It because BMW want to get more profit, they have lots of debt and the best profitability, so the result of these three ratios is BMW's solvency ability is the worst. But in interest coverage, BMW's profitability is the best, it means the ability to pay debt interest of BMW is best. So according this ratio ,BMW have the best ability of solvency.

And then, Daimler don't have too much debt, so their profit was limited and interest was not very high, we can say Daimler's solvency ability is very health. Comparing with Volkswagen, from chart 4.1 and chart 4.4, we can know, from 2010 to 2011, although Volkswagen Group had higher debt to assets ratio, however they didn't get higher interest coverage, it because in these years, Daimler had stronger profitability. And the interest coverage is increased in 2012 and decreased in 2013. The reason is in 2012, total liabilities in Volkswagen Group was rose up, so the interest was increased as well in that year. And because in that year, Volkswagen Group has more liabilities to use, the profits in 2012 is also increased, so interest coverage was increased in 2012. After the acquiring in 2012, Volkswagen Group increased the dividend, so in 2013, total liabilities was decreased and cause the decreasing of interest. And because the profits in 2013 is increased, so interest coverage was decreased in 2013.

So according interest coverage, the ability of solvency of the Volkswagen Group is worst but in 2012. Even in the rest of the year, they have very big difference from other companies, especially BMW. And we can see the interest coverage of Volkswagen Group in 2014 is more than it in 2013, the reason is in 2014, Volkswagen Group acquire Porsche company, so the EBIT of Volkswagen Group is increased in that year, that cause the increasing of interest coverage.

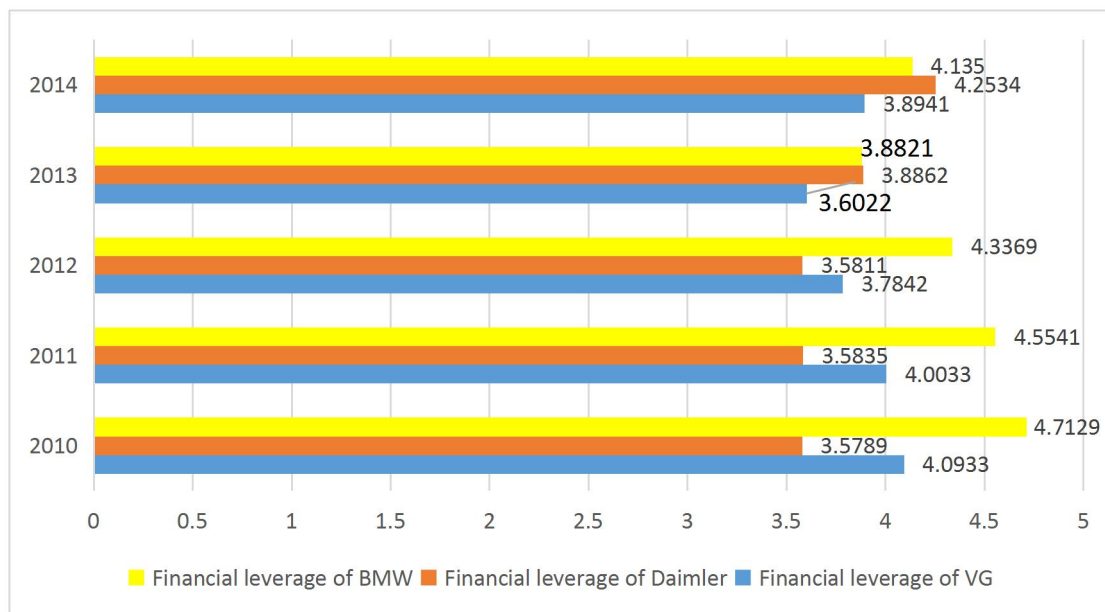
#### **4.1.4 Financial leverage of Volkswagen Group.**

The last ratio is financial leverage, we will calculate this ratio of Volkswagen Group, Daimler AG and BMW Group. Financial leverage can help us to know the company's total assets, and the size of the creditor in the investment. The results are presented as Tab.4.3 and comparison of financial leverage in these three companies is shown as Chart 4.3.

Tab.4.3 Financial leverage of Volkswagen Group, Daimler AG and BMW Group.

	2010	2011	2012	2013	2014
Financial leverage of VG	4.0933	4.0033	3.7842	3.6022	3.8941
Financial leverage of Daimler	3.5789	3.5835	3.5811	3.8862	4.2534
Financial leverage of BMW	4.7129	4.5541	4.3369	3.8821	4.1350

Chart 4.3 Comparison of financial leverage of VG, Daimler and BMW.



Calculations is based on formula (2.10). From chart 4.3 we can see the situation of these three company's financial leverage ratio, we can see the tendency of the financial leverage ratio of these three companies are the same with the tendency of debt to assets ratio of these three companies.

Leverage ratio can measure the ability that company to expand the size of the business, and reveal the degree of shareholder's rights to use. The higher the ratio, the greater the ability of companies to expand business, stockholders' equity can be fully used, the more opportunities to get more profit, and bring more benefits for shareholders, but leverage maybe to take bigger risks. So higher financial leverage means high risk, we can say that in 2013, Volkswagen's solvency ability is strongest in this period, also in these three companies. We use it to analyze solvency ability, because it changes related to debt to assets ratio. In the rest of thesis, we will use it.

## 4.2 Pyramidal decomposition analysis of Volkswagen Group.

In this part, we will make pyramidal decomposition analysis of Volkswagen Group's solvency. By using pyramidal decomposition analysis, we can know each factor's influence on solvency ratio of Volkswagen Group. We also can find which factor has the strongest influence on solvency ratio in different years. The managers of the company can make the adjustments of their financial position based on the results of pyramidal decomposition.

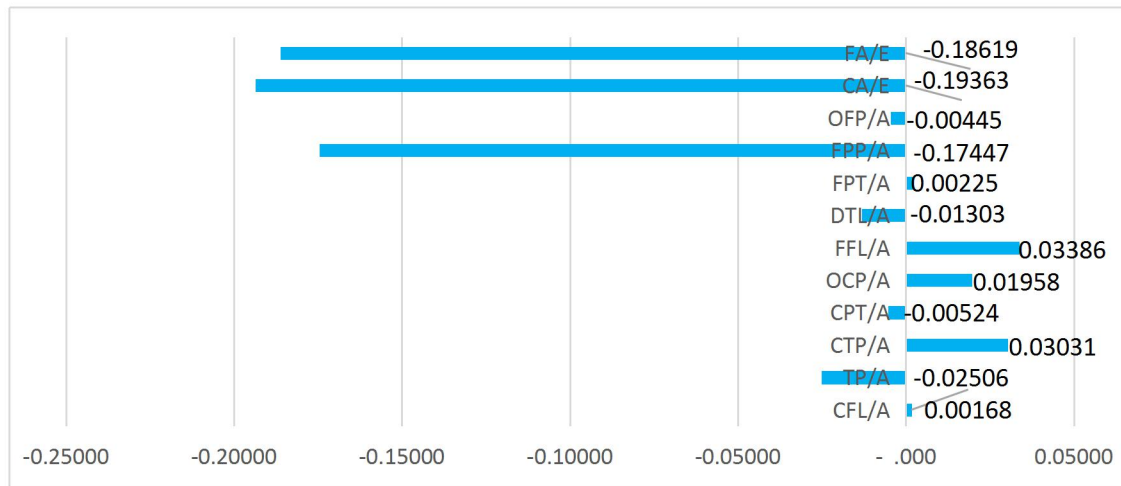
There are four types of solvency ratio. They are debt to assets ratio, debt to equity ratio, interest coverage and financial leverage. In this section, we will decompose debt-to-equity ratio into financial leverage and debt-to-assets ratio. And we will make the comparison with Daimler AG, we chose Volkswagen Group as the basic indicator and use Daimler AG as the comparative indicator.

The results of every indicator's influence on DTE in 2010 are showed in Tab 4.5 and Chart 4.5.

*Tab 4.5 Pyramidal decomposition of DTE of Volkswagen Group and Daimler AG in 2010.*

	Influence	Order	Influence (-,+)
CFL/A	0.00168	12	+
TP/A	-0.02506	6	-
CTP/A	0.03031	5	+
CPT/A	-0.00524	9	-
OCP/A	0.01958	7	+
FFL/A	0.03386	4	+
DTL/A	-0.01303	8	-
FPT/A	0.00225	11	+
FPP/A	-0.17447	3	-
OFP/A	-0.00445	10	-
CA/E	-0.19363	1	-
FA/E	-0.18619	2	-
$\Sigma$	-0.51438		

Chart 4.5 Influence of pyramidal decomposition of DTE of Volkswagen Group and Daimler AG in 2010.



From Tab.4.5 we can know that CA/E has the strongest influence on DTE in 2010, it's influence is negative 0.19363. And the second one is FA/E, it's also a negative factor, it's influence is negative 0.18620. The third one is FPP/A, it is negative 0.18619. We can see DTE is decomposed into 12 indicators, the sum of all the indicators is negative 0.51438, it is the absolutely change of DTE between Volkswagen Group and Daimler AG in 2010. DTE in this year is negative means that DTE of Daimler AG is higher than it of Volkswagen Group.

From Chart 4.5, it is very clear to see there are 5 positive factors and 7 negative factors. CA/E has the biggest negative influence on DTE, and FFL/A has the biggest positive influence on DTE, it is positive 0.03386. The influence of CA/E, FA/E and FPP/A are really bigger than other indicators, so if the company want to keep DTE in a health level, they must control these three indicators.

And if we decrease CA of Volkswagen Group and increase CA of Daimler AG in 2010, CA/E will be increased, and DTE will be increased as well. So if the company want to decreased their DTE, they should increase CA of Volkswagen Group and decrease CA of Daimler AG at the same time.

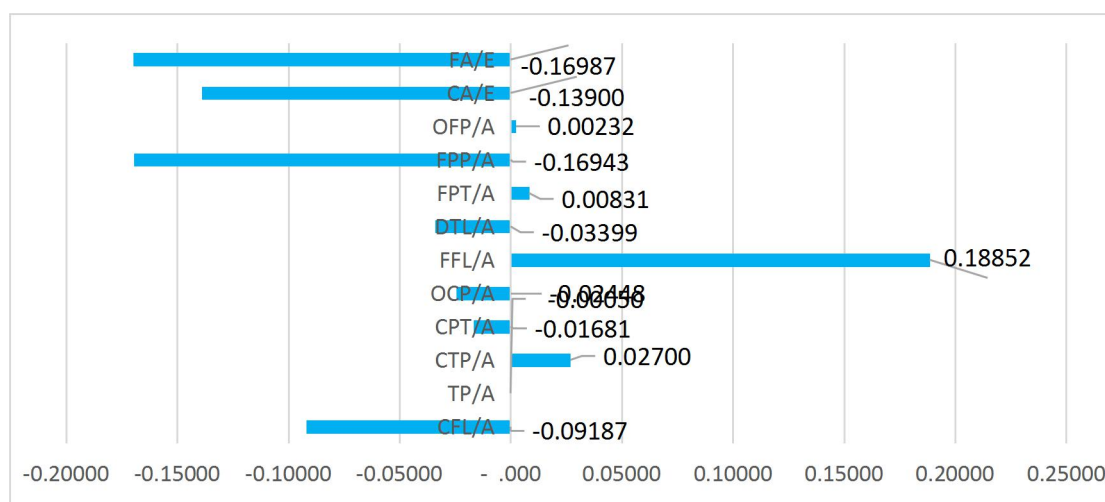
The results of every indicators' influence on DTE in 2011 is shown in Tab 4.6 and Chart 4.6.



Tab 4.6 Pyramidal decomposition of DTE of Volkswagen Group and Daimler AG in 2011.

	Influence	Order	Influence (-,+)
CFL/A	-0.09187	5	-
TP/A	-0.00050	12	-
CTP/A	0.02700	7	+
CPT/A	-0.01681	9	-
OCP/A	-0.02448	8	-
FFL/A	0.18852	1	+
DTL/A	-0.03399	6	-
FPT/A	0.00831	10	+
FPP/A	-0.16943	3	-
OFP/A	0.00232	11	+
CA/E	-0.13900	4	-
FA/E	-0.16987	2	-
$\Sigma$	-0.41981		

Chart 4.6 Influence of pyramidal decomposition of DTE of Volkswagen Group and Daimler AG in 2011.



From Tab.4.6 we can know there are just 4 positive factors of DTE in 2011. The most strongest positive indicator on DTE is FFL/A, it is 0.18852. And FA/E has the biggest negative influence on DTE, it is 0.16987, FPP/A is really close to FFL/A, it is 0.16943. The sum of all the indicators is negative 0.41981, it is smaller than it in the last year.

If we compare Tab.4.6 with Tab.4.5, we can find that the top three negative indicators and the biggest positive indicator are the same. For the company, if DTE is lower, that means the long-term liabilities position in that company is very good. So if

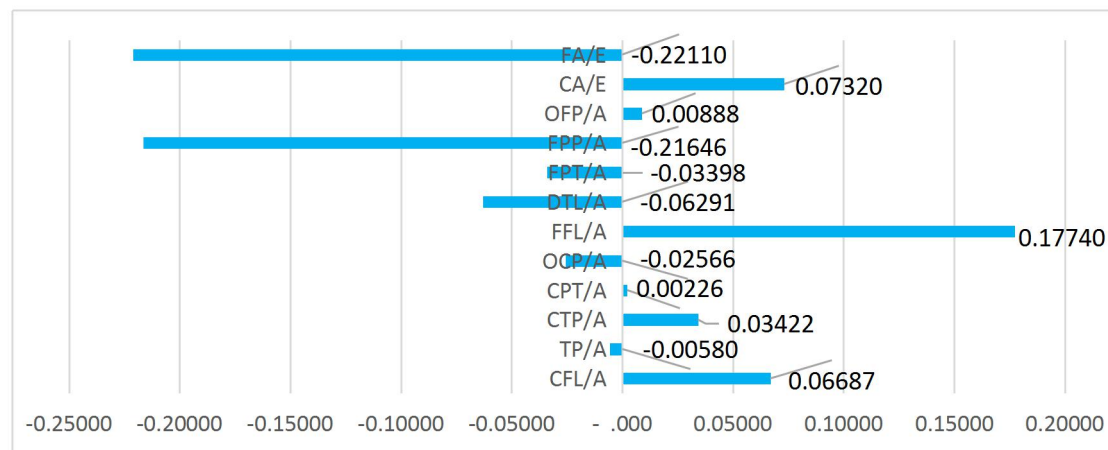
the company wants to decrease their DTE in 2011, they can increase FA, FPP or CA of Volkswagen Group when decreasing them of Daimler AG.

The results of every indicators' influence on DTE in 2012 is shown in Tab 4.7 and Chart 4.7.

Tab 4.7 Pyramidal decomposition of DTE of Volkswagen Group and Daimler AG in 2012.

	Influence	Order	Influence (-,+)
CFL/A	0.06687	5	+
TP/A	-0.00580	11	-
CTP/A	0.03422	7	+
CPT/A	0.00226	12	+
OCP/A	-0.02566	9	-
FFL/A	0.17740	3	+
DTL/A	-0.06291	6	-
FPT/A	-0.03398	8	-
FPP/A	-0.21646	2	-
OFP/A	0.00888	10	+
CA/E	0.07320	4	+
FA/E	-0.22110	1	-
$\Sigma$	-0.20308		

Chart 4.7 Influence of pyramidal decomposition of DTE of Volkswagen Group and Daimler AG in 2012.



From Tab.4.7 we can see FA/E has the strongest negative influence on DTE in 2012, it is negative 0.22110. The second one is FPP/A, it is negative 0.21646, the following indicator is FFL/A, it is positive 0.17740. There are 6 positive indicators and 6 negative indicators of DTE, sum of them is negative 0.20308. It is lower than it

in the last year, that means the difference between DTE of Volkswagen Group and DTE of Daimler AG in 2012 is smaller than it in 2011.

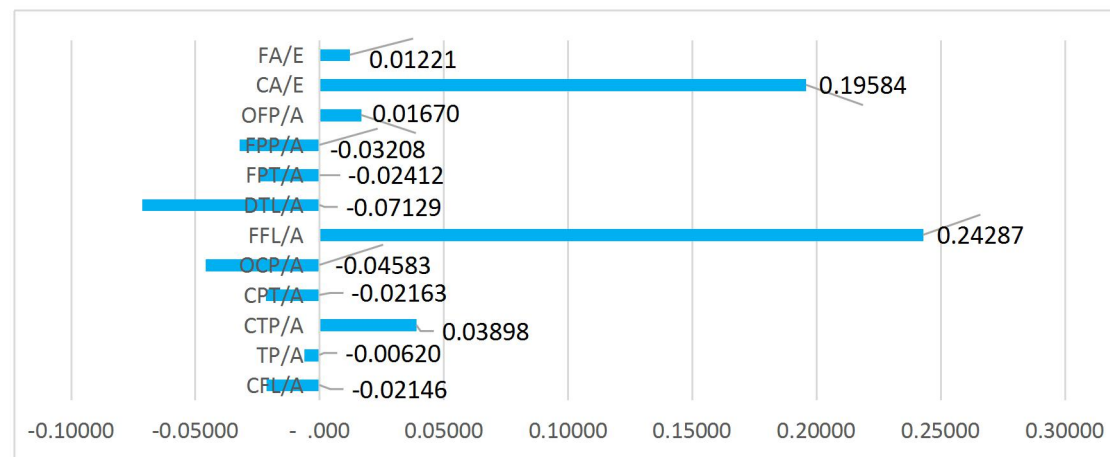
In 2012, if we increase FA of Volkswagen Group to 296582 million euro, and decrease FA of Daimler AG to 85520 million euro, FA/E will decrease about 0.249. Therefore, if the company want to decrease their DTE, they can increase FA of Volkswagen Group and decrease FA of Daimler AG.

The results of every indicators' influence on DTE in 2013 is shown in Tab 4.8 and Chart 4.8.

*Tab 4.8 Pyramidal decomposition of DTE of Volkswagen Group and Daimler AG in 2013.*

	Influence	Order	Influence (-,+)
CFL/A	-0.02146	9	-
TP/A	-0.00620	12	-
CTP/A	0.03898	5	+
CPT/A	-0.02163	8	-
OCP/A	-0.04583	4	-
FFL/A	0.24287	1	+
DTL/A	-0.07129	3	-
FPT/A	-0.02412	7	-
FPP/A	-0.03208	6	-
OFP/A	0.01670	10	+
CA/E	0.19584	2	+
FA/E	0.01221	11	+
$\Sigma$	0.28399		

*Chart 4.8 Influence of pyramidal decomposition of DTE of Volkswagen Group and Daimler AG in 2013.*



From Tab.4.8, we can know there are five positive indicators of DTE in 2013. FFL/A has the biggest positive influence on DTE, it is positive 0.24287, and DTL/A has the biggest negative influence on DTE, it is negative 0.07129. And the sum of all the indicators is 0.28399.

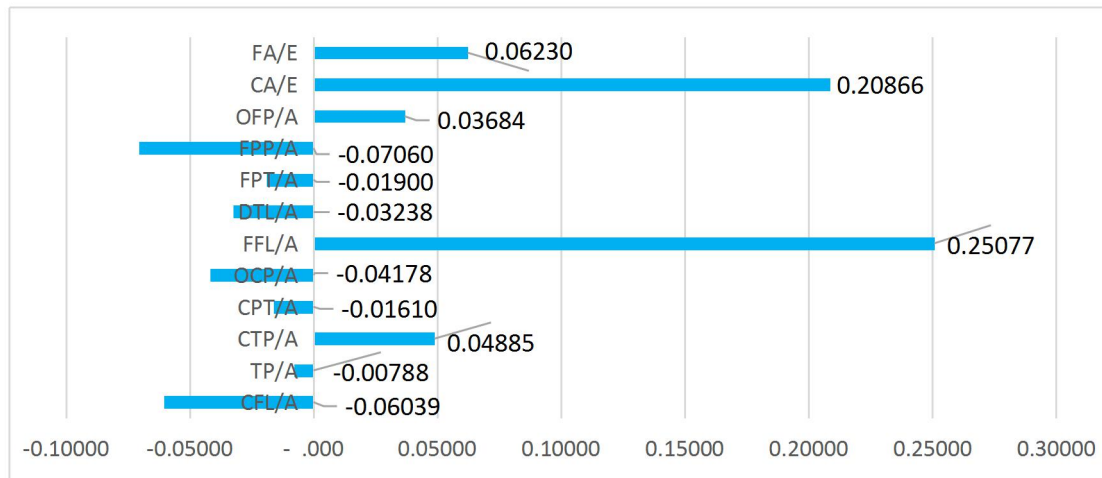
Comparing Tab.4.7 and Tab.4.8, it is easy to find DTE in 2013 is really higher than it in 2012, it rose by 0.48707. We can see FA/E, CA/E and FPP/A has a large increase in 2013. FA/E in 2012 is negative 0.22110 and in 2013 is positive 0.01221, it rose by 0.2333. CA/E in 2012 is positive 0.07320 and in 2013 is positive 0.19584, it increased 0.1226. FPP/A in 2012 is negative 0.21646 and in 2013 is negative 0.03208, it increased 0.1844. That is the reason why DTE in 2013 is higher than it in 2012.

The results of every indicators' influence on DTE in 2014 is shown in Tab 4.9 and Chart 4.9.

*Tab 4.9 Pyramidal decomposition of DTE of Volkswagen Group and Daimler AG in 2014.*

	Influence	Order	Influence (-,+)
CFL/A	-0.06039	5	-
TP/A	-0.00788	12	-
CTP/A	0.04885	6	+
CPT/A	-0.01610	11	-
OCP/A	-0.04178	7	-
FFL/A	0.25077	1	+
DTL/A	-0.03238	9	-
FPT/A	-0.01900	10	-
FPP/A	-0.07060	3	-
OFP/A	0.03684	8	+
CA/E	0.20866	2	+
FA/E	0.06230	4	+
$\Sigma$	0.35929		

Chart 4.9 Influence of pyramidal decomposition of DTE of Volkswagen Group and Daimler AG in 2014.



From Tab.4.10 we can see the sum of these 12 indicators is positive 0.35929, and there are five positive factors of DTE in 2014. FFL/A has the strongest influence on DTE, it is positive 0.25077, the following positive factor is CA/E, it is 0.20886.

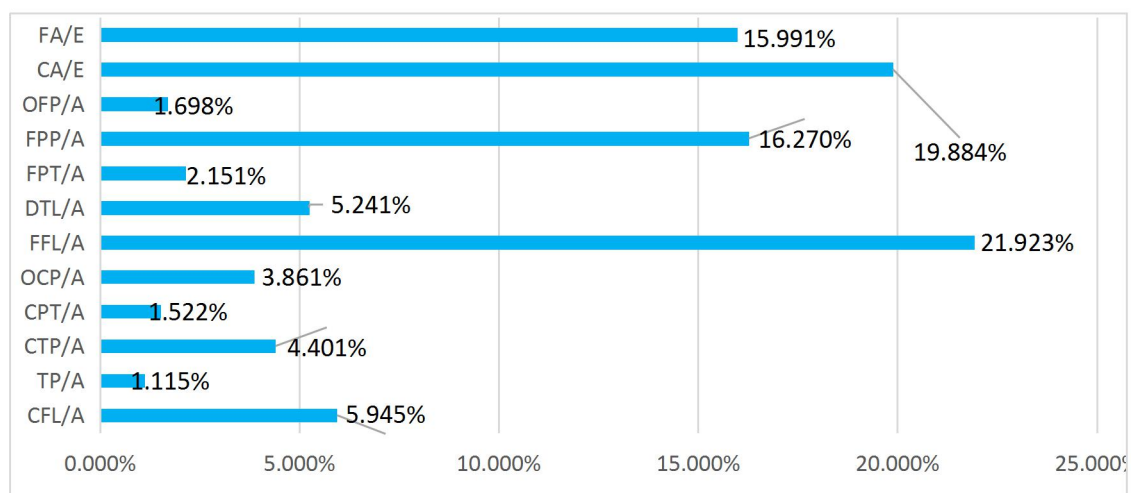
And if we increase FFL to 86608 million euro of Volkswagen Group and decrease FFL to 43043 million euro of Daimler AG in 2014, FFL/A will decrease 0.33067, DTE also will be decreased. So if the company want to decrease their DTE in order to have a health long-term liabilities position, they can increase FFL of Volkswagen Group and decrease FFL of Daimler AG like the example.

The results of summary of every indicators' influence on DTE from 2010 to 2014 are showed in Tab 4.10 and Chart 4.10.

Tab 4.10 Pyramidal decomposition of DTE of Volkswagen Group and Daimler AG from 2010 to 2014.

years influence	2010	2011	2012	2013	2014	Sum	Own-Influence	Order
CFL/A	0.00168	0.09187	0.06687	0.02146	0.06039	0.24227	5.945%	5
TP/A	0.02506	0.00050	0.00580	0.00620	0.00788	0.04544	1.115%	12
CTP/A	0.03031	0.02700	0.03422	0.03898	0.04885	0.17936	4.401%	7
CPT/A	0.00524	0.01681	0.00226	0.02163	0.01610	0.06204	1.522%	11
OCP/A	0.01958	0.02448	0.02566	0.04583	0.04178	0.15733	3.861%	8
FFL/A	0.03386	0.18852	0.17740	0.24287	0.25077	0.89342	21.923%	1
DTL/A	0.01303	0.03399	0.06291	0.07129	0.03238	0.2136	5.241%	6
FPT/A	0.00225	0.00831	0.03398	0.02412	0.01900	0.08766	2.151%	9
FPP/A	0.17447	0.16943	0.21646	0.03208	0.07060	0.66304	16.270%	3
OFP/A	0.00445	0.00232	0.00888	0.01670	0.03684	0.06919	1.698%	10
CA/E	0.19363	0.13900	0.07320	0.19584	0.20866	0.81033	19.884%	2
FA/E	0.18619	0.16987	0.22110	0.01221	0.06230	0.65167	15.991%	4
$\Sigma$						4.07535		

Chart 4.10 Influence of pyramidal decomposition of DTE of Volkswagen Group and Daimler AG from 2010 to 2014.



In the summary, we calculate the absolute value of each indicators. And we calculate the whole value in the past five years of each indicators, then we add all value of the 12 indicators and use each value divided by the whole value to see the

influence of each indicators.

From Tab.4.10 and Chart 4.10, we can know FFL/A has the biggest influence on DTE, it is 21.923%, and CA/E is the second factor, the following one is FPP/A and FA/E. These four indicators all make a great contribution to DTE. Their influence on DTE are more clearly than other indicators. And TP/A has the smallest influence on DTE, it is only 1.115%, so if TP just change a little, it is hard to see it's influence on DTE.

Comparing all the table, we can find that if the company want to control their DTE, they should pay attention on FFL and make FFL in a ideal level in order to get the ideal DTE.

### **4.3 Sensitivity analysis of Volkswagen Group.**

Sensitivity analysis is an analysis that used to find the sensitivity factors which has the important influence on the target indicator from lots of different uncertain factors. From sensitivity analysis, we can know the relationship between the independent factors and a particular dependent indicator, and the independent factor's influence on the particular indicator.

In this part, we will make the sensitivity analysis of debt to equity ratio of Volkswagen Group to find the influence of the selected factors on DTE. As we written before, we composed DTE into 12 indicators, so we choose two of them as the selected factors to do the sensitivity analysis. They are E and CFL. The results are showed in Tab.4.11 and Chart 4.11.

*Tab.4.11 Sensitivity analysis of debt to equity ratio. (million euro)*

Change(%)	$\Delta E$	$\Delta DTE$	$\Delta CFL$	$\Delta DTE$
15%	13528.4	-0.08558	13102.5	0.4372
10%	9018.9	0.02881	8735	0.3888
5%	4509.5	0.15410	4367.5	0.3403
0%	0	0.29191	0	0.2919
-5%	-4509.5	0.44424	-4367.5	0.2435
-10%	-9018.9	0.61349	-8735	0.1951
-15%	-13528.4	0.80265	-13102.5	0.1466

We choose equity and current financial liabilities as the sensitivity factors. We will calculate the changes of debt to equity ratio when we increase equity and current financial liabilities by 5%, 10% and 15%, and decrease them by 5%, 10% and 15%. The original debt to equity ratio without any changes of equity and current financial liabilities is 0.29191.

For almost all the companies whose operating situation is good, the higher DTE means they can have more capital to use for the production. Especially the great scale company, like Volkswagen Group, borrowing capital is good for getting more profits, but this way will have the negative influence on the company's solvency. So on the same time, in order to reduce the risk, DTE shouldn't be very high.

From the sensitivity analysis, we can know for  $\Delta E$ , when we increase equity, debt to equity ratio will decrease. That means equity has negative influence on debt to equity ratio. If we increase equity by 10%, equity will rise by 9018.9 million euro, and DTE will drop down to 0.02881, the company will have a lower financial leverage. For  $\Delta CFL$ , we can know from Tab.4.11, when we increase equity and CFL by 10%, the influence of equity on DTE is greater than the influence of CFL on DTE. So equity is more sensitive than CFL, and is more important for debt to equity ratio. When the managers want to change DTE by changing CFL, we can know when we increase it, debt to equity ratio will be increased as well, it is a positive factor of DTE.



When CFL rise by 10%, it will be 96085 million euro, and debt to equity ratio will rise to 0.70952.

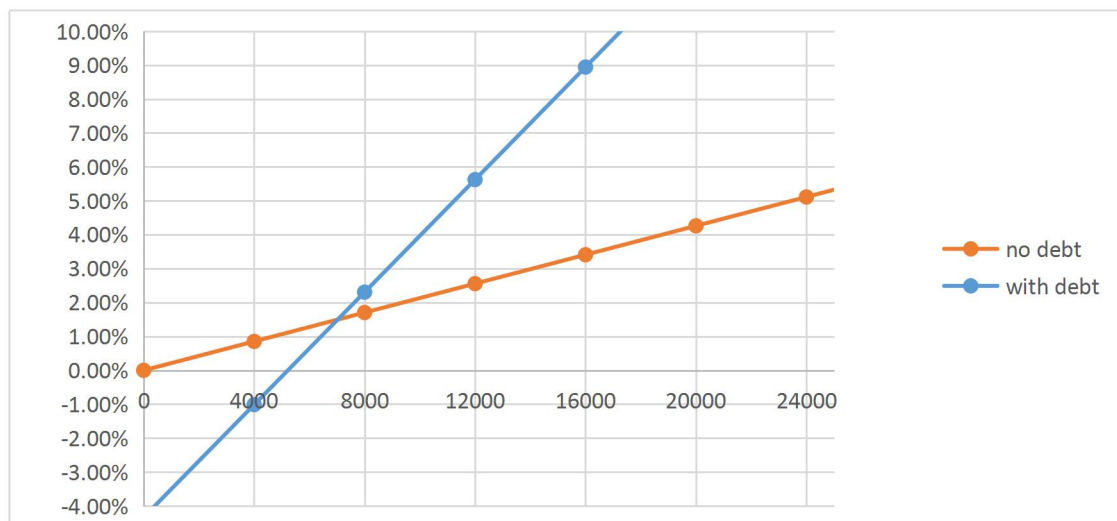
According to the sensitivity analysis of DTE, we can know when E is increasing, DTE will decrease, when D rise up, DTE will rise up as well. As the manager of a company, they need to keep the company in a great financial situation, a good DTE can give the company more benefits. But we can't judge the situation is good for the company or not by only using DTE, so we need to calculate the ROE after the sensitivity analysis of DTE.

We change the capital structure of the company by increase the E or reduce the D in order to influence the ROE of the company. Because the manager can only change the capital structure of the company, but can't increase or decrease the total assets of the company, so if the manager want to increase the D, they need to reduce the E. And the company's operating aim in the next step is to choose the best capital structure to get the highest ROE. Before this, we need to make a assumption: if the total D is lower than 261020, it is the total D in 2014 of Volkswagen Group, the interest rate will be 2%. Because 2% is lower enough, although the company reduce their debt, the interest rate can't be lower. But if the company increase the debt, the bank and the creditor will face a bigger risk of default, so when the debt rise up by 10% of the amount of the equity in 2014, the interest will rise up by 0.5%. And we make the effect of financial leverage, we calculate the ROE of different situation. The results is shown as Tab.4.12 and Chart 4.11.

Tab.4.12 ROE of different situation.

Interest rate	2%	2%	2%	2%	2%	2%	2.5%	3.0%	3.5%	4.0%
Scenario	1	2	3	4	5	6	7	8	9	10
D	215925	224944	233963	242982	252001	261020	270039	279058	288077	297096
E	135284	126265	117246	108227	99208	90189	81170	72151	63132	54113
D/E	1.60	1.78	2.00	2.25	2.54	2.89	3.33	3.87	4.56	5.49
EBIT	17452	17452	17452	17452	17452	17452	17452	17452	17452	17452
I	4319	4499	4679	4860	5040	5220	6751	8372	10083	11884
EBT	13134	12953	12773	12592	12412	12232	10701	9080	7369	5568
EAT	9826	9691	9556	9421	9286	9151	8006	6793	5513	4166
ROE	7.26%	7.67%	8.15%	8.70%	9.36%	10.15%	9.86%	9.42%	8.73%	7.70%

Chart 4.11 Effect financial leverage.

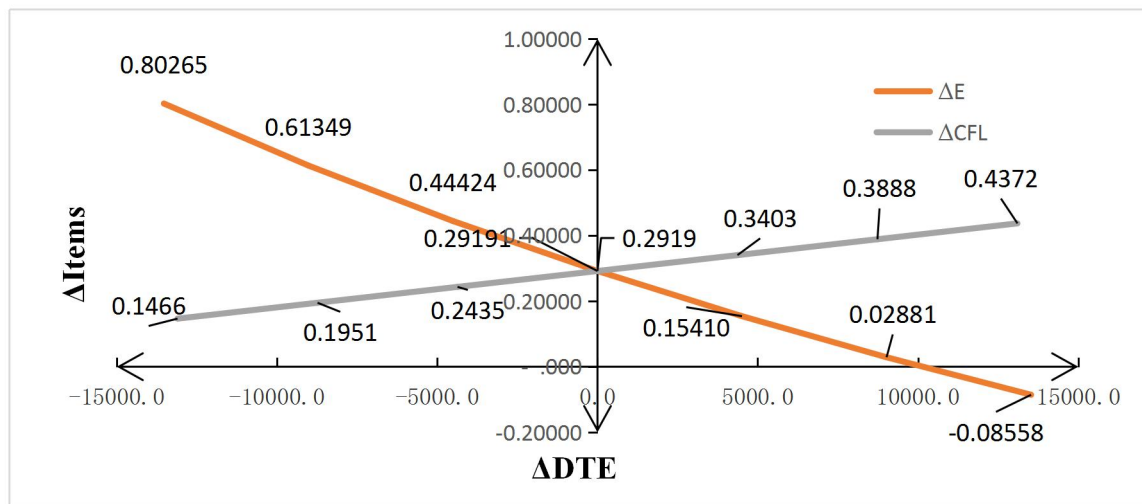


From our calculation, we find that when E is the same as 2014, the ROE of Volkswagen Group is the highest. In this situation, the debt will be 261020, the equity will be 90189, the ROE is 10.15%. That means if the company want to get a high ROE in the future, they can make the capital structure stable. But the financial cost of debt and the financial cost of equity is not the same, so we need to consider the changes of the EBIT in this capital structure. So we increase the EBIT gradually, observe the changes of ROE under the no-debt situation and the best DTE situation, and then make the comparison. The break-even point is 7014.18, we find when the

EBIT is bigger than 7024.18, the capital structure which has more debt is better than the no-debt structure, the ROE in the first structure is higher than the second one. When the EBIT is lower than 7024.18, the ROE from the no-debt structure is bigger. So we think, in 2015, the company can keep the debt amount the same as it in 2014 in order to let the company get a ideal capital structure and get a ideal ROE. In that situation, the debt is 261020, the equity is 90189 and the ROE is 10.15%.

From Tab.4.11, we can know when we increase equity and CFL by 10%, the influence of equity on DTE is greater than the influence of CFL on DTE. So equity is more sensitive than CFL, and is more important for debt to equity ratio.

Chart 4.12 Sensitivity analysis of DTE .



From Chart 4.12, we can see  $\Delta E$  and  $\Delta CFL$  both are straight and sloping line. When  $\Delta DTE$  is 0.29191, they are equal to each other. The main difference between them is the slope of  $\Delta E$  is negative but the slope of  $\Delta CFL$  is positive. If Volkswagen Group wants to have more liabilities to use, they should increase debt to equity ratio, they can increase CFL. And if they want to have a health long-term liabilities position, they need decrease debt to equity ratio, they can increase equity to get a higher DTE.

#### 4.4 Summary of solvency of Volkswagen Group

In this chapter, we made analysis of solvency of Volkswagen Group by using the methods which we have introduced in chapter 2. There are three methods in this chapter: solvency ratio analysis of Volkswagen Group, the pyramidal decomposition analysis of Volkswagen Group and sensitivity analysis of Volkswagen Group.

The first part is solvency ratio analysis of Volkswagen Group. Solvency ratio includes debt to assets ratio, debt to equity ratio, financial leverage and interest coverage. Debt to assets ratio of Volkswagen Group from 2010 to 2014 is around 0.73. The ideal debt to assets ratio of a company is supported to be from 0.4 to 0.6. And the debt to equity ratio is also higher than 1. It means Volkswagen Group borrows more money to run its business. The company needed to pay more interest and face a large financial risk. If Volkswagen Group wants to improve its ability of solvency, it will increase its debt and attract more investors to contribute to the company.

The second part was Pyramidal decomposition analysis of Volkswagen Group. From the data during 2010 and 2014, we could see that there are four positive indicators of DTE and eight negative indicators. And FPP/A is always the negative factor of DTE. And FFL/A is not only always the positive factor of DTE, but also always has the biggest positive influence on DTE in the past five years. If Volkswagen Group wants to control its debt to equity ratio, it should concentrate on FFL and make FFL in a ideal level in order to get the ideal DTE. The company want the ideal DTE because they want to have a better solvency.

The last part was Sensitivity analysis of Volkswagen Group. We chose equity and current financial liabilities as the selected factors to do the sensitivity analysis. Equity has negative influence on debt to equity ratio and current financial liabilities has positive influence. When  $\Delta DTE$  is 0.29191,  $\Delta E$  and  $\Delta CFL$  are equity to each other. If the company want to have a better solvency, they can increase equity by issuing more shares or sell more products to get a smaller DTE. Or increase the liabilities when borrowing money is good for the company and reduce the liabilities when borrowing money is bad for the company. These ways all can help the company to get a better solvency.

## 5. Conclusion

Through the analysis of solvency of Volkswagen Group in the automotive sector, we could understand its financial position. To managers, it could help them maintain the company's solvency at an appropriate level. To the creditors and the investors, the solvency ratio can show them whether the company can use their cash flow to cover their short-term liabilities and long-term liabilities or not. They are the really important financial indicators for a company.

The aim of this thesis is to make the assessment of solvency of Volkswagen Group by using common-size analysis, solvency ratio analysis, pyramidal decomposition and sensitivity analysis from 2010 to 2014.

This thesis was divided into five parts. The first part is introduction, it is the chapter 1. In this part, we introduce solvency of company, the aim of this thesis and the main content of each chapter.

In the chapter 2, we introduced three basic financial statements: balance sheet, income statement and cash flow statement. And then, we introduced common size analysis and solvency ratio. Common size analysis has vertical common size analysis and horizontal common size analysis. Solvency ratio included debt to assets ratio, debt to equity ratio, interest coverage and financial leverage of Volkswagen Group. We described the definition and formulas of them. At last, we introduced what is pyramidal decomposition, sensitivity analysis and return on equity.

In chapter 3, we described main financial characteristics of Volkswagen Group. Firstly, we introduced the history and structure of the company. History helped us understand the development of company. Structure of the company helped us know the institutions that supervise and regulate the whole company. Then, we calculated vertical common size analysis and horizontal common size analysis of the company from 2010 to 2014. We could see the absolute change and percentage change between each two years. It showed the trend of the company how it change during five years.

In chapter 4, we described solvency ratio analysis. We calculated debt to assets ratio, debt to equity ratio, interest coverage and financial leverage. From this ratio, we

could see the financial health was not very good from 2010 to 2014 of Volkswagen Group. The debt to assets ratio was over 0.7 and debt to equity was higher than 1. The company should pay more attention to attract investors. In addition, we also introduced pyramidal decomposition analysis of Volkswagen Group's solvency. We could know FPP/A is always the negative factor of DTE. And FFL/A is always the positive factor of DTE from 2010 to 2014. Lastly, we described Sensitivity analysis. We chose equity and current financial liabilities to do sensitivity. Equity was negative to debt to equity ratio. Current financial liabilities was positive to debt to equity ratio.

In chapter 5, it was conclusion. This part concluded the whole thesis.

From this thesis we can learn how to analysis the solvency of a company. We know how to calculate common size analysis, solvency ratios and pyramidal decomposition. We know the basic information about Volkswagen Group and evaluate the solvency of it.

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## List of Abbreviations

EBIT	Earning before interest and taxes
EAT	Earning after taxes
EBT	Earning before taxes
DTE	Debt to equity ratio
ROE	Return on equity
D	Debt
E	Equity
CA	Current assets
FA	Fixed assets
A	Assets
CD	Total current debt
FD	Total fixed debt
FFL	Fixed financial liabilities
DTL	Deferred tax liabilities
FPT	Provision for taxes of fixed portion
FPP	Provision for pensions of fixed
OFP	Other fixed provision
CFL	Current financial liabilities
TP	Trade payable
CTP	Current tax payable
CPT	Provision for taxes of current portion
OCP	Other current provision

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Jiahao Fu 付嘉豪

Student's name and surname

## **List of Annexes**

Annexes 1: Balance sheet of Volkswagen Group

Annexes 2: Income statement of Volkswagen Group

*Annexes I: Balance sheet of Volkswagen Group. (million euro)*

	2010	2011	2012	2013	2014
<b>Assets</b>					
<b>Non-current assets</b>					
Intangible assets	13 104	21 992	59 158	59 243	59 935
Property, plant and equipment	25 847	31 916	39 424	42 389	46 169
Leasing and rental assets	11 812	16 626	20 034	22 259	27 585
Investment property	252	340	433	427	485
Equity-accounted investment	13 528	10 249	7 309	7 934	9 874
Other equity investment	640	3 049	3 870	3 941	3 683
Financial services receivables	35 817	42 450	49 785	51 198	57 877
Other receivables and financial assets	7 519	14 405	8 102	8 496	8 152
Non-current tax receivables	689	627	552	633	468
Deferred tax assets	4 248	6 333	7 915	5 622	5 878
	<b>113 457</b>	<b>147 986</b>	<b>196 582</b>	<b>202 141</b>	<b>220 106</b>
<b>Current asset</b>					
Inventories	17 631	27 551	28 674	28 653	31 466
Trade receivables	6 883	10 479	10 099	11 133	11 472
Financial services receivables	30 164	33 754	36 911	38 386	44 398
Other receivables and financial assets	6 605	8 796	10 695	11 621	12 773
Current tax receivables	482	623	761	729	1 010
Marketable securities	5 501	6 146	7 433	8 492	10 861
Cash, cash equivalents and time deposits	18 670	18 291	18 488	23 178	19 123
	<b>85 936</b>	<b>105 640</b>	<b>113 062</b>	<b>122 192</b>	<b>131 103</b>
<b>Total assets</b>	<b>199 393</b>	<b>253 626</b>	<b>309 644</b>	<b>324 333</b>	<b>351 209</b>

<b>Equity and Liabilities</b>					
<b>Equity</b>					
Subscribed capital	1 191	1 191	1 191	1 191	1 218
Capital reserves	9 326	9 329	11 509	12 658	14 616
other reserves	35 461	47 019	64 815	73 884	157
Non-controlling interests	2 734	5 815	4 310	2 304	198
	<b>48 712</b>	<b>63 354</b>	<b>81 825</b>	<b>90 037</b>	<b>90 189</b>
<b>Non-current liabilities</b>					
Non-current financial liabilities	37 159	44 443	63 603	61 517	68 416
Other non-current liabilities	4 742	6 940	7 072	6 832	8 192
Deferred tax liabilities	1 669	4 125	9 050	7 894	4 774
Provision for pensions	15 432	16 787	23 969	21 774	29 806
Provision for taxes	3 610	3 721	4 239	3 674	3 215
Other non-current provision	11 170	13 200	14 373	13 981	15 910
	<b>73 781</b>	<b>89 216</b>	<b>122 306</b>	<b>115 672</b>	<b>130 314</b>
<b>Current liabilities</b>					
Current financial liabilities	39 852	49 090	54 060	59 987	65 564
Trade payables	12 544	16 325	17 268	18 024	19 530
Current tax payables	286	844	238	218	256
Other current liabilities	10 627	16 097	15 536	15 530	21 786
Provision for taxes	2 077	2 888	1 721	2 869	2 791
Other current provision	11 513	15 812	16 689	18 360	17 075
	<b>76 900</b>	<b>101 057</b>	<b>105 513</b>	<b>118 625</b>	<b>130 706</b>
<b>Total equity and liabilities</b>	<b>199 393</b>	<b>253 626</b>	<b>309 644</b>	<b>324 333</b>	<b>351 209</b>

*Annexes 2: Income statement of Volkswagen Group. (million euro)*

	2010	2011	2012	2013	2014
<b>Sales revenue</b>	126875	159337	192676	197007	202458
Costs of sales	-105431	-131371	-157518	-161407	-165934
<b>Gross profit</b>	<b>21444</b>	<b>27965</b>	<b>35158</b>	<b>35600</b>	<b>36524</b>
Distribution expense	-12213	-14582	-18850	-19655	-20292
Administrative expense	-3287	-4384	-6223	-6888	-6841
Other operating income	7648	9727	10496	9956	10298
Other operating expenses	-6450	-7456	-9070	-7343	-6992
<b>Operating profit</b>	<b>7141</b>	<b>11271</b>	<b>11510</b>	<b>11671</b>	<b>12697</b>
Share of profits and losses of equity-accounted					
Investments	1944	2174	13568	3588	3988
Finance costs	-2144	-2047	-2552	-2366	-2658
Other financial result	2053	7528	2967	-465	767
<b>Financial result</b>	<b>1852</b>	<b>7655</b>	<b>13982</b>	<b>757</b>	<b>2097</b>
<b>Profit before tax</b>	<b>8994</b>	<b>18926</b>	<b>25492</b>	<b>12428</b>	<b>14794</b>
Income tax income/expenses	-1767	3126	-3608	-3283	-3726
current	-2963	4351	-4196	-3733	-3632
deferred	1196	1225	588	449	-94
<b>Profit after tax</b>	<b>7226</b>	<b>15799</b>	<b>21884</b>	<b>9145</b>	<b>11068</b>
Noncontrolling interests	392	391	168	52	84
Profit attributable to shareholders of Volkswagen AG	6835	15409	21717	9093	10985
<b>Basic earning per ordinary share in c</b>	<b>15.17</b>	<b>33.1</b>	<b>46.42</b>	<b>18.61</b>	<b>21.84</b>
<b>Diluted earnings per ordinary</b>	<b>15.17</b>	<b>33.1</b>	<b>46.42</b>	<b>18.61</b>	<b>21.84</b>

<b>share in</b>					
<b>Basic earnings per preferred share in</b>	<b>15.23</b>	<b>33.16</b>	<b>46.48</b>	<b>18.67</b>	<b>21.9</b>
<b>Diluted earnings per preferred share in</b>	<b>15.23</b>	<b>33.16</b>	<b>46.48</b>	<b>18.67</b>	<b>21.9</b>