VALUATION: VOLKSWAGEN AG

Advanced Corporate Finance

By:
Alamgir Hossain (20201823)
Mark Fisker (20175658)
Anker Frydkjær (20175224)

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1. Introduction

The project seeks to analyze and understand a chosen worldwide corporation within the global automotive industry. The recent development inside the automotive industry suggests that technology becomes more essential in which it disrupts traditional automobile production. The current shift from fossil fuel to electric vehicles supports the worldwide aim of a sustainable industry and environment. Numerous corporations operate within the industry, thus only one corporation is investigated as the main focus is to perform an in-depth analysis within a field of corporate finance, wherefore several topics within corporate finance are left out. Additionally, the analyses are founded in modern and recognized economic theory.

Many corporations operate within the global automotive industry with different brands; however, the sector is dominated by few. Among those, five corporations are chosen for an initial overview with peer comparison of fundamental key financial. The overview is presented in Table 1.1 and provides an appetizing snapshot per 31.12.2020 from a broad span of financial insight.

Peer comparison - Prices and Ratios for The Automotive industry

Key Financial						
Revenue	222,88 B	98,99 B	154,31 B	26,80 B	229,74 B	104,06 B
EPS (Diluted)	16,62 EUR	5,73 EUR	3,39 EUR	0,54 EUR	3,68 EUR	8,47 EUR
Dividend Per Share	4,83	1,93	1,35	0	3,61	0,38
Payout Ratio %	29,28 %	43,63 %	26,55 %	0,00 %	35,02 %	8,78 %
Share Price 16.04.20	242,10 EUR	88,19 EUR	77,35 EUR	627, 73 EUR	133,65 EUR	49,80 EUR
Market Cap 16.04.20	135,37 B	57,04 B	82,74 B	602,53 B	186,32 B	71,75 B
Profitability Ratios						
EBITDA Margin %	10,36 %	8,85 %	8,70 %	13,54 %	13,18 %	11,14 %
Net Income Margin %	3,96 %	3,90 %	2,60 %	2,73 %	6,92 %	5,16 %
ROE %	6,99 %	6,35 %	6,41 %	5,42 %	7,16 %	13,22 %
ROA %	1,47 %	1,36 %	1,61 %	2,82 %	2,11 %	2,31 %
Additional Figures						
Net Working Capital	29,53B	135,37 B	135,37 B	135,37 B	135,37 B	135,37 B
Current Ratio	1,18	1,14	1,15	1,88	1,05	1,01
Valuation Measures						
P/E	17,80	15,46	22,84	1154	15,70	13,54
Price/Book	1,17	0,96	1,36	33,91	1,09	1,82
Enterprise Value	302,44	147,78	202,51	598,62	367,91	147,04
EV/EBITDA	13,10	16,87	15,08	164,90	11,40	12,91

Table 1.1 - Peer Comparison (Yahoo Finance, 2021).

2. Aim of the project

The aim of the project focuses on Volkswagen Group (*Volkswagen*), aiming to derive a qualified understanding of future prospects for Volkswagen upon quantitative analysis throughout the project, mainly in the area of *fundamental analysis* and secondary within the *capital structure*. Fundamental analysis and capital structure are viewed as two essential fields within corporate finance.

Firstly, historical information for Volkswagen is derived within the timeframe of 01.01.2016 - 31.12.2020, mainly focusing on the balance sheet and the income statement. Furthermore, information of Volkswagen's capitalization is incorporated as well.

The first part involves a fundamental analysis of Volkswagen by estimating forecasted income statements and balance sheets in the forecast horizon of 2021 - 2026. The forecasted income statements and balance sheets are applied in the context of calculating the free cash flow. The fundamental analysis is terminated by estimating the prospect of firm value in 2026 discounted to the beginning of 2021 to compare with the capitalization value per share of Volkswagen per 31.12.2020. In the bargain, scenario analysis is developed to understand the effects of both weighted average cost of capital (WACC) and terminal growth as two fundamental aspects for the purpose of valuing Volkswagen.

The second part focuses on the capital structure of Volkswagen and their current leverage acknowledging that investment decisions and financing decisions are both independent and mutually dependent upon each other. From there, a simplified quantitative analysis of Volkswagen's income statement in 2020 is performed to quantify the benefits from raising more debt and to understand the effects toward shareholders of either no leverage and more leverage.

At the end, the project discusses the findings and limitations presented in the project. Graphical illustration the project structure are illustrated in Table 1.2

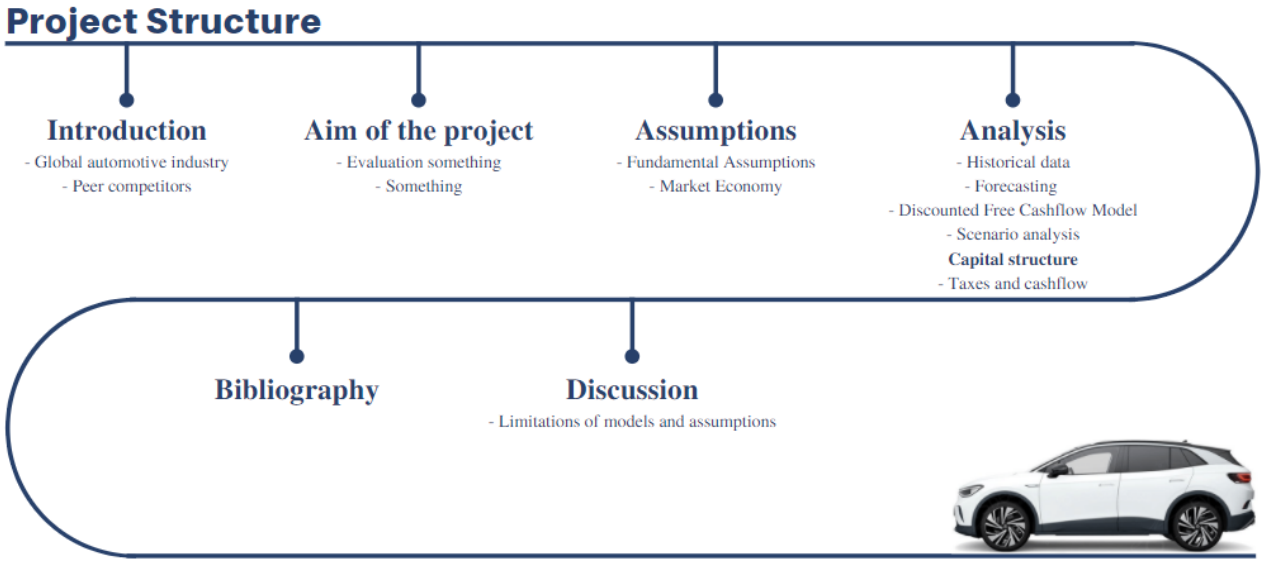

Table 1.2

3. Fundamental assumptions

The project is written with respect to generally recognized economic theory within the field of capital markets and finance. The analyses consider several theoretical assumptions, thus more general assumptions apply as well. Required assumptions to carry out the analyses are stated and must be established as an essential necessity.

Corporations are understood as legal entities separated from the owner (Berk, DeMarzo & Harford, 2019, p. 36). Corporations are entitled to enter contracts, acquire assets, and hold responsibilities. Furthermore, a corporation is protected towards the seizure of their property at the same level as individuals (Berk et al., 2019, p. 36).

Corporations operate within the capital market with relationships to other legal entities, individuals, institutions, governments, and more on both national, multinational, and continental levels with respect to the law under which they operate under. The presence of capital markets supports the efficiency of the market in relation to both capital markets, and that prices are determined by supply and demand. Intercorrelated, corporations are profit maximizing (Berk et al., 2019, p. 36), wherefore corporations must streamline their business in order to either satisfy demand or reduce cost until an equilibrium is established. If corporations fail to do so in the long run, they will go out of business eventually. In order to streamline their business, corporations must operate assets and liabilities efficiently to maximize the wealth of shareholders. The aforementioned is closely related

to the financial manager's three main tasks, managing investment decisions, managing financing decisions, and taking the necessary action to secure required cash to run the operation (Berk et al., 2019, p. 40-41).

Therefore, within the field of corporate finance, the project seeks to maximize shareholder's wealth.

4. Fundamental analysis

Presented chart in Table 2.1 demonstrates the process in which the fundamental analysis is covered. At the initial stage, the project provides basic information of Volkswagen's key share information, enterprise value and WACC. In the second stage, a sample period is applied to estimate the future income statement and balance sheet. At the final stage, to evaluate the value of Volkswagen's discounted free cash flow, firm value and scenario analysis are analyzed for broader perspectives.

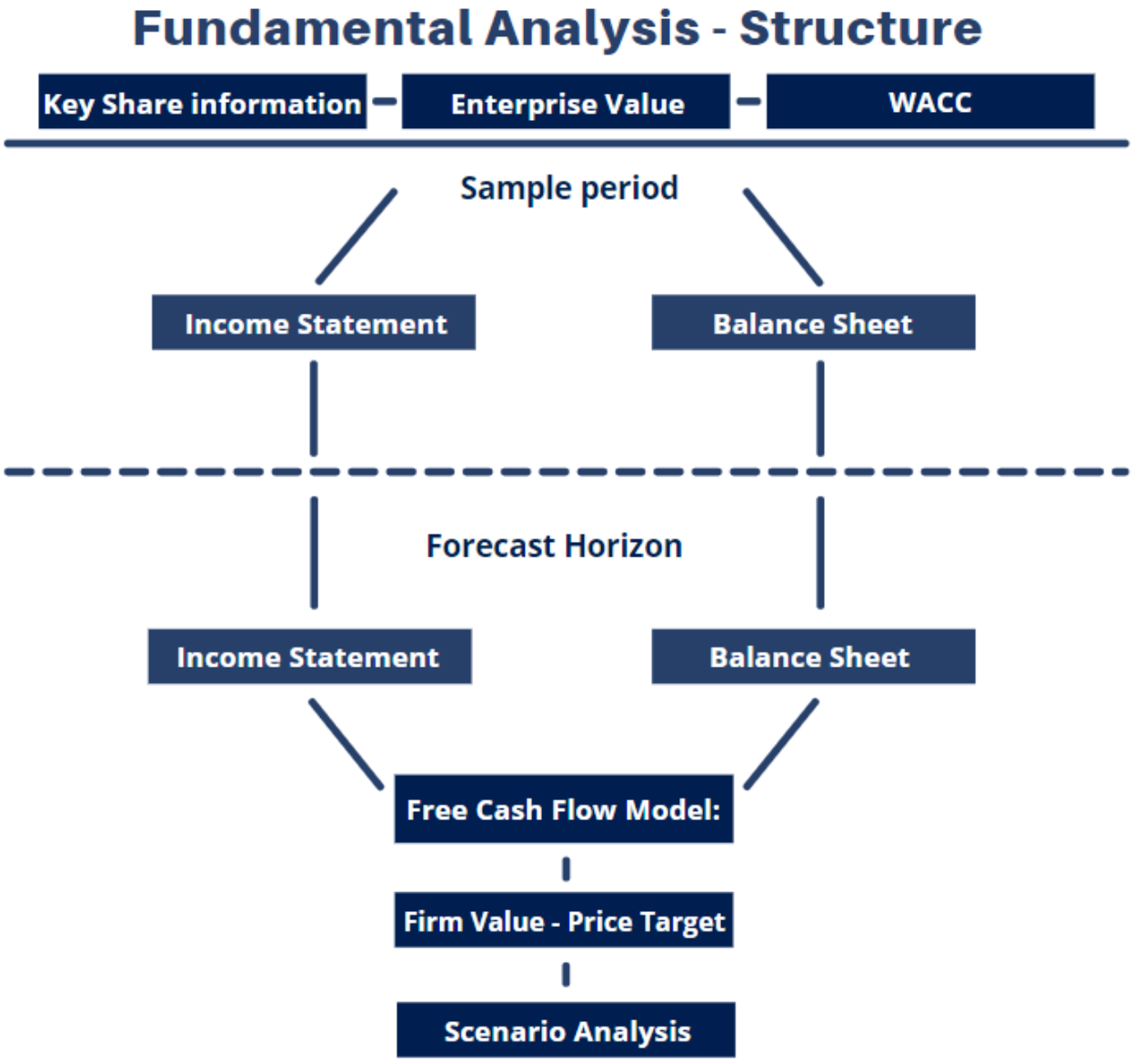

Table 2.1 - Fundamental Analysis

Initially, before taking the necessary steps to forecast both the income statement and balance sheet, three main areas are presented briefly. Those three areas include *WACC, enterprise value, and key share information.* The aforementioned areas are applied for different purposes during the project.

4.1 Key share information:

A selection of figures relating to Volkswagen's share in the sample period is considered, hence beta (*systematic and undiversifiable risk)*, common and preferred share price *(implied share price*), common and preferred number of shares *(implied shares outstanding*). The information is found in public accessible annual reports (Ernst & Young, 2021, p. 113).

The elements are applied to calculate the market capitalization of Volkswagen. It is assumed that the implied number of shares represents the accumulated common and preferred shares. Furthermore, implied share price refers to the share price that contributes to the total value of market capitalization. Full market capitalization (*market capitalization)* follows equation 1,

$$Market\ capitalization = Shares\ outstanding * Share\ price \qquad \text{Eq. 1.}$$

(Brealey, Myers & Allen, 2020, p. 79).

The rationale matches the approach taken by Volkswagen in their annual reports, confirming a market capitalization of €81,6 billion per 31.12.2020 illustrated by Table 2.2,

Share price development[2]		2020	2019	2018	2017	2016
Ordinary share						
Closing	€	170.10	173.25	139.10	168.70	136.75
Price performance	%	−1.8	+24.6	−17.5	+23.4	−3.9
Annual high	€	183.10	182.50	188.00	173.95	144.20
Annual low	€	101.50	135.60	131.10	128.70	108.95
Preferred share						
Closing	€	152.42	176.24	138.92	166.45	133.35
Price performance	%	−13.5	+26.9	−16.5	+24.8	−0.3
Annual high	€	185.52	184.24	188.50	178.10	138.80
Annual low	€	87.20	134.76	133.70	125.35	94.00
Beta factor[3]	factor	1.26	1.17	1.17	1.12	1.22
Market capitalization at Dec. 31	€ billion	81.6	87.5	69.7	84.1	67.9
Equity attributable to Volkswagen AG shareholders and hybrid capital investors at Dec. 31	€ billion	127.0	121.8	117.1	108.8	92.7
Ratio of market capitalization to equity	factor	0.64	0.72	0.60	0.77	0.73

Table 2.2 - Share information (Ernst & Young, 2021, p. 113).

Key share information for Volkswagen are summarized in Table 2.3,

Key share information	*2016*	*2017*	*2018*	*2019*	*2020*	22.04.2021
Beta	1,22	1,12	1,17	1,17	1,26	
Common shares	295090000	295090000	295090000	295090000	295090000	295090000
Price per common share	€136,75	€168,70	€139,10	€173,25	€170,10	€283,00
Preferred share	206205000	206205000	206205000	206205000	206205000	206205000
Price per preferred share	€133,35	€166,45	€138,92	€176,76	€152,42	€230,30
Market Capitalization (millions)	€67.850,99	€84.104,51	€69.693,02	€87.573,14	€81.624,58	€130.999,48

Table 2.3 - Key Share Information

Market capitalization of €81.6 billion per 31.12.2020 is confirmed following equation 2,

$$€81,624 = 295090000 * €170.10 + 206205000 * €152.42 \quad \text{Eq. 2.}$$

4.2 Enterprise value:

The enterprise prices the entire corporation including both the market value of equity and debt while adjusting for both cash and cash equivalents (Berk et al., 2019, p. 64). In the project, debt is defined as interest-bearing debt, both current and noncurrent. Therefore, other liabilities like trade payables, deferred tax payables, provisions e.g., are not implemented for the purpose of calculating Volkswagen's enterprise value. In addition, the enterprise value considers cash and marketable securities as assets attributing positively to the value that an entity must pay for the entire corporation. Non-current debt is defined as *financial liabilities* and *other financial liabilities* (€114,906 million per 2020), where financial liabilities represent *bonds, commercial paper and notes, liabilities to banks, deposit business, loans, and miscellaneous liabilities, lease liabilities*. Furthermore, other financial liabilities represent *interest payables* (Ernst & Young, 2021, p. 273). Current debt refers to the same liabilities, thus the debt of the carried amount accumulates to a total of €89,592 million per 31.12.2020 (Ernst & Young, 2021, p. 273). Enterprise value follows equation 3

$$EV = market\ cap. + \ debt - cash - marketable\ securities \quad \text{Eq. 3}$$

(Berk et al., 2019, p. 64)

Enterprise value is estimated to €230,712 million per 31.12.2020 as illustrated in Table 2.4

Enterprise value	*2016*	*2017*	*2018*	*2019*	*2020*
Market capitalization (millions)	€67.851	€84.105	€69.693	€87.573	€81.625
Non-current debt (millions)	€66.406	€81.672	€103.259	€113.672	€114.906
Current debt (millions)	€89.042	€82.414	€90.418	€89.252	€89.252
Cash (millions)	€19.265	€18.457	€28.938	€25.923	€33.909
Marketable securities (millions)	€17.520	€15.939	€17.080	€16.769	€21.162
Implied share price	€135	€168	€139	€175	€163
Enterprise value (millions)	€186.514	€213.795	€217.352	€247.805	€230.712

Table 2.4 - Enterprise Value

4.3 Weighted Average Cost of Capital (WACC)

Volkswagen informs WACC for each year in their automotive division, thus Volkswagen also operates with a *financial services division.* However, Volkswagen does only publish elements to be considered for calculation of WACC for their automotive division. Furthermore, Volkswagen informs that their after-tax cost of equity is 9.30% and cost of debt 1.00% based on the proportion of equity and debt at 66.70% and 33.30%, respectively. WACC follows equation 4,

$$WACC = r_D \frac{D}{V} + r_E \frac{E}{V} \qquad \text{Eq. 4}$$

(Brealey et al., 2020, p. 231),

Bear in mind, that equation 4 shows the standard WACC does not consider the after-tax effect. However, thus the values of both cost of debt and cost of equity are stated as after-tax figures, equation 4 holds. The proposed WACC at 6.50% is incorporated in the later presented discounted cash flow.

Furthermore, Volkswagen informs that their cost of equity is based upon the Capital Asset Pricing Model *(CAPM)* with a market risk premium of 7.5%, a risk-free rate of -0.2% and systematic risk (beta) of 1.26 (Ernst & Young, 2021, p. 129).

Applied assumptions in the upcoming analysis are summarized in Table 2.5,

Weighted Average Cost of Capital after-tax	
Assumptions	
Cost of equity (after tax)	9,30%
Cost of debt (after tax)	1,00%
Proportion of equity	66,70%
Proportion of debt	33,30%
Market risk premium	7,50%
Risk-free rate	-0,20%
Beta	1,26
Weighted average Cost of Capital	6,5%

Table 2.5 - Weighted Average Cost of Capital After-tax

4.4 Income statement:

The fundamental analysis considers the income statement and balance sheet information from Volkswagen in years 2016 - 2020. The income statement and balance sheet are rewritten to fit the purpose of forecasts for the horizon of 2021 - 2026 and the terminal year in 2027.

Initially, it is assumed that the revenue increases by 3.00% per year during the forecast horizon.

In the income statement, core operating costs represent the *cost of sales, distribution expenses* and *administrative expenses, other operating income and expenses* which fluctuate and depend upon the revenue for each year. The revised income statement incorporates the result of other operating income and expenses as core operating costs, hence the operating result indicates *earnings before interest and taxes* (EBIT). However, the rationale is validated by a correlation of 99.09%. On average, during the sample period, the cost of sales accounts for 93.78% of the revenue and will be applied during the forecast horizon.

Furthermore, depreciation and amortizations (*depreciation)* is not stated directly in the income statement but entered for the purpose of calculating the free cash flow. The annual average increase of 7.17% in depreciation during the sample period is applied for the forecast horizon.

The financial result considers the *share of the result of equity-accounted investments, interest income, interest expenses, and other financial results.* No indications of dependency or correlation upon revenue or other income statement figures are discovered during the investigation. Therefore, an average factor achieved from the sample period of the three figures is applied in the forecast horizon. Earnings before taxes (EBT) represent the cumulative operating and financial result each year. Net income represents the result after *taxes* to Volkswagen shareholders where taxes include income tax expenses and a marginal sum paid to both non-controlling interest parties and hybrid investors. For the purpose of forecasting *taxes,* an average percentage of 25.59% of earnings attributable to shareholders of Volkswagen of EBT is applied.

In this context, it is assumed that taxes and leverage are relevant in the choice of both investment and financing decisions by top management and investors, equivalent to what is proposed by Modigliani and Miller's *correction* (Modigliani & Miller, 1963) to their initial paper in 1958. In this context, they challenge and discuss their own assumption of *perfect capital markets*, hence no taxes. Bear in mind that depreciation as illiquid cash flows does not affect Volkswagen's cash flow, however, depreciation is applied for the later presented free cash flow model. Assumptions to carry out forecasted income statements are summarized in Table 2.6,

Income statement	
Assumptions	
Revenue increase per year	3,00%
Cost of operating costs of revenue	94,69%
Depreciation increase per year	7,17%
Interest expenses (constant)	-2.327
Interest income (constant)	981
Other financial results (constant)	2.424
Taxes per year of EBT	25,59%

Table 2.6 - Assumption of Income Statement

The forecasted income statement reformulation is presented in Table 2.7

(millions)	End sample period			Forecast horizon				
Income Statement	*2020*	*2021*	*2022*	*2023*	*2024*	*2025*	*2026*	***Terminal year***
Revenue	222884	229571	236458	243551	250858	258384	266135	*274119*
Core operating costs	213209	217385	223906	230624	237542	244668	252009	*259569*
Operating result (EBIT)	9675	12186	12551	12928	13316	13715	14127	*14550*
Depreciation	25749	27595	29573	31694	33966	36401	39011	*41808*
Interest expenses	-2291	-2327	-2327	-2327	-2327	-2327	-2327	*-2327*
Interest income	793	981	981	981	981	981	981	*981*
Other financial results	3489	2424	2424	2424	2424	2424	2424	*2424*
Financial result	1991	1079	1079	1079	1079	1079	1079	*1079*
Earnings before tax	11667	13264	13630	14006	14394	14794	15205	*15629*
Taxes	-3333	-3394	-3488	-3584	-3684	-3786	-3891	*-4000*
Net Income	8334	9870	10142	10422	10711	11008	11314	*11629*

Table 2.7 - The Forecasted Income Statement Reformulation

4.5 Balance sheet historical data:

The balance sheets are reformulated and simplified for the purpose of forecasting, hence leaving out individual figures from both assets and liabilities, implying that only *current assets, total assets, current liabilities, total liabilities and equity* are forecasted. In this case, forecasting of *cash and equivalents, marketable securities, inventories e.g.,* are left out of the topic and apply as well to separate figures for fixed assets, current liabilities and non-current liabilities.

Current assets and total assets are forecasted by an annual average increase during the sample period at 5.89% and 4.99%, respectively. Total liabilities and equity are forecasted with an annual average increase throughout the sample period at 4.89% and 8.53%, respectively. Furthermore, no significant change in current liabilities is discovered in the sample period, wherefore an average factor of €163,841 is applied for the forecast horizon.

Assumptions carried out in the forecast horizon are summarized in Table 2.8,

Balance sheet	
Assumptions	
Current assets increase per year	5,89%
Total assets increase per year	4,99%
Equity increase per year	8,63%
Current liabilities (constant)	167841
Total liabilities increase per year	4,53%

Table 2.8 - Assumption of Balance Sheet

Additionally, more information is derived from the forecasted income statement and balance sheet. The net working capital, representing the working capital leftovers after paying all current liabilities with current assets (Brealey et al., 2020, p. 137), illustrates the firm's ability to cover its current liabilities with assets that *easily* are converted into cash. In addition, the change in net working capital is calculated for each year in the forecast horizon.

Forecasted balance sheet reformulation is presented in Table 2.9

	End sample period	Forecast horizon						
	2020	*2021*	*2022*	*2023*	*2024*	*2025*	*2026*	*Terminal year*
Balance sheet								
Total current assets	194.944	206.419	218.570	231.437	245.060	259.486	274.761	*290.934*
Total assets	497.114	521.897	547.915	575.230	603.906	634.013	665.620	*698.803*
Liabilities and equity								
Current liabilities	165.410	167.841	167.841	167.841	167.841	167.841	167.841	*167.841*
Total liabilities	368.331	384.832	402.071	420.083	438.902	458.564	479.107	*500.570*
Equity	128.783	139.892	151.960	165.068	179.307	194.774	211.576	*229.827*
Total liabilities and equity	497.114	524.724	554.031	585.151	618.209	653.339	690.683	*730.397*
Net working capital	29.534	38.578	50.729	63.595	77.219	91.645	106.919	*123.093*
Change in net working capital	9.992	9.044	12.151	12.866	13.624	14.426	15.275	*16.174*

Table 2.9 - The Forecasted Balance Sheet Reformulation

4.6 Free Cash-Flow

Initially, Volkswagen informs in their annual report for 2020, that capex (capital expenditures) account for 6.1% of the revenue (Ernst & Young, 2021, p. 365).

The average capex-ratio during the sample period of 6.54% is applied during the forecast horizon.

Continuing with elements derived from both income statements and the balance sheets, the free-cash-flow model is calculated for the purpose of calculating Volkswagen's discounted firm value. Free cash flow of firm follows equation 5,

$$FCF = Net\ income + Depreciations - Change\ in\ NWC - Capital\ expenditures$$ Eq. 5

(Berk et al., 2019, p. 619).

The free cash flow model is presented in Table 2.10,

Year	2020	2021	2022	2023	2024	2025	2026	Terminal year
Free Cash Flow Model								
Net Income	8.334	9.870	10.142	10.422	10.711	11.008	11.314	11.629
Plus: Depreciation	25.749	27.595	29.573	31.694	33.966	36.401	39.011	41.808
Less. Increase in NWC	-9.992	-9.044	-12.151	-12.866	-13.624	-14.426	-15.275	-16.174
Less: Capital Expenditures	-13.596	-15.014	-15.464	-15.928	-16.406	-16.898	-17.405	-17.927
Free Cash Flow of Firm	10.495	13.407	12.100	13.321	14.647	16.085	17.645	19.336

Table 2.10 - The Free Cash Flow Model

To summarize, the net income is estimated throughout the forecasted income statement, including illiquid depreciations as attributing positively to the free cash flow. Increases in net working capital is derived from the balance sheet as the difference between current assets and liabilities from one year to another. Furthermore, capital expenditures at 6.54% of the revenue are the required capital investment that Volkswagen must invest each year. The free cash flow does not take into consideration the tax advantage of interest expenses. This assumption and rationale are derived as a result of applying an after-tax WACC when discounting the cash flows to the origin of the forecast horizon. Therefore, implementing both tax advantage and after-tax WACC would be considered double counting.

4.7 Firm value

In the last part of the fundamental analysis for Volkswagen, the firm value is calculated and scenario analysis upon WACC and terminal growth is applied as well. The calculation considers the free cash flow of Volkswagen in the forecast horizon (2021 – 2026) and the following terminal year. The cash flows are discounted to the beginning of 2021 with Volkswagen's after-tax WACC hence 6.5% as presented in section 4.3. The present value of free cash flows follows equation 6

$$PV_{FCF} = \frac{FCF_1}{1+WACC^1} + \frac{FCF_2}{1+WACC^2} + \frac{FCF_n}{1+WACC^n}$$ Eq. 6

(Brealey et al., 2020, p. 513).

The horizon value is derived by treating the cash flow in the terminal year as a perpetual cash flow, hence a constant growth model. The after-tax WACC is adjusted for assumed constant growth

forever and assumed terminal growth rate at 2.5%. The function of horizon value follows equation 7,

$$PV_{H(2027)} = \frac{FCF_H}{WACC - g} \quad \text{Eq. 7}$$

(Brealey et al., 2020, p. 515)

Furthermore, the horizon value is discounted to the origin (the year 2021) by WACC.

Thereafter, when the firm value is calculated, the equity value is derived by deducting the debt in 2020 from the firm value. Lastly, the target share price is derived from dividing the equity value by implied numbers of shares per 31.12.2020.

The results are presented in Table 2.11,

		1	2	3	4	5	6	
Firm Value		2021	2022	2023	2024	2025	2026	**terminal year**
Free Cash Flow of Firm		13.407	12.100	13.321	14.647	16.085	17.645	19.336
PV Free Cash Flow (WACC) - 2021-	69.503	12588,55404	10668,17053	11028,04669	11385,40098	11740,27272	12092,70479	
Continuation Value / terminal value (DCF-model)								483396,3885
PV Continuation Value (WACC)	331.288		**DCF model**					
Firm Value	400.791		Firm value	400.791.187.663		**Share value - fundamental analysis**		
			Debt	204.158.000.000		31.12.2020	163	implied price
debt	204.158,00		Equity value	196.633.187.663		Forecasted	392	implied price
Value of equity	196.633		Implied share price	**392,25**		Potentially upside		140,90%
Forecast summary								
Equity value	Implied shares	Share price target	Implied share price	Potential upside				
196633187663	501295000	392	163	140,90%				

Table 2.11 - The Discounted Cash Flow Model

The fundamental analysis indicates that the forecasted present value of free cash flow during the forecast horizon, and the present value of horizon value in total accumulate to €400,791 million. Thereafter, when debt is paid out, the equity value suggests a net sum of €196,633 million, hence a target share price of €392.25. The fundamental analysis suggests a potential upside of 140.90% compared to the implied share price of €163 per 31.12.2020.

4.8 Scenario analysis

To contribute to more scenarios, the target price per share is investigated under several conditions. In the original calculation, the target share price was a function of discounting the present value of free cash flows during the forecast horizon and the present value of the terminal value. Recall that the annual report assumed that the cash flows should be discounted with a WACC of 6.5% (Ernst & Young, 2021, p. 129) and that the cash flow in the terminal year would grow forever with 2.5%. However, it is not sufficient to price the share without taking into consideration how the target share

price fluctuates and depends upon changes in either terminal growth rate or WACC. Therefore, the target share price is calculated under different scenarios under several scenarios in the range of WACC from 5.00% - 8.00% and terminal growth rate in the range of 1.00% - 4.00%.

The results from different scenarios of both WACC and terminal growth are presented in Table 2.12,

DCF TARGET: EUR 392

Cost of debt	Cost of Equity	WACC	Terminal Growth
1,0%	9,30%	6,50%	2,50%

WACC \ Terminal Growth	1,00%	1,50%	2,00%	2,50%	3,00%	3,50%	4,00%
5,50%	358	435	535	669	855	1135	1601
6,00%	278	338	413	511	640	821	1093
6,50%	212	260	319	**392**	487	613	789
7,00%	157	196	243	300	372	463	586
7,50%	111	143	181	227	282	352	441

Table 2.12 - Scenario Analysis

Under standardized conditions, the target share price is €392. However, upon scenario analysis, it is recognized that this share price indeed depends on which scenarios the cash flow is treated under. The most optimistic scenario indicates a price target per share of €2,617, while the worst scenario indicates a price per share of €72.

5. Capital structure

5.1 Advantage of debt

The capital structure part seeks to investigate occurred changes from dispersion in leverage. The first part of this investigation considers a simplified reformulation of Volkswagen's income statement and how Volkswagen benefits from financing assets with debt.

Thereafter, the analysis examines potential additional benefits from a leveraged recapitalization and the effects on investors. Finally, findings are compared to those of which Volkswagen realized for 2020.

5.2 Tax shield on income statement

Recall forecasted income statement in Table 1.9 including information from 2020. EBIT accumulates to a total of €9,675 million in 2020. Furthermore, actual interest expenses constituted €2,291 million. Realized values for 2020 are incorporated in the example. However, this does not correspond identically to the annual report as interest income and other financial results are left out, wherefore tax expenses differ from what is stated in the income statement. The cost of debt at 1.12% is derived by the linear relationship between the interest-bearing debt of €204,158 presented in section 4.3 and interest expenses in 2020 are applied in the analysis.

The analysis is based upon Modigliani and Miller's *corrected* proposition from 1963, assuming both leverage and taxes influence investment and financing decisions. Value contribution from carrying debt is recognized and reflects the advantage of tax-deductible interest expenses (Modigliani & Miller, 1963, p. 436-442).

Total cash flow to shareholders and bondholders reflects Volkswagen's firm value and positive contribution of carrying debt. The value of a levered corporation in accordance with Modigliani and Miller's correction paper is expressed in equation 8,

$$Firm\,Value_L = V_U + T_c D \qquad \text{Eq. 8}$$

(Brealey et al., 2020, p. 479).

Opposite to the income statement forecasts, the United States marginal tax rate of 21.00% in 2020 is applied for the analysis (Tax Policy Center, 2021).

The first part of the analysis considers a hypothetical example where Volkswagen finances its entire operation with equity, wherefore no interest expenses occur. Necessary assumptions are summarized in Table 3.1,

Assumptions	
Corporate tax and leverage matter	
Modigaliani and Miller proposition	
EBIT	9.675,00
Cost of debt	1,12%
Interest expenses	-2.291,00
Taxes	21,00%
Book value of equity, 2020	128.783,00

Table 3.1 - Assumptions of Corporate Tax and Leverage Matter

The second part considers interest expenses for 2020. Effects of carrying debt are reflected in total cash flow attributable to shareholders and bondholders with positive contributions equal to the

reduction in corporate taxes. In addition, the effect from tax-shield is reflected in return on the book value of equity. Results are presented in Table 3.2,

	2020	
	Unleverred w. tax)	Leverred w. tax)
Taxes and cash flow		
EBIT	9.675	9.675
Interest expenses	0	-2291
EBT	9.675	7.384
Taxes	-2031,75	-1550,64
EAT	7.643	5833,36
Total cash flow to share	7.643	8124,36
Return on equity	5,93%	6,31%

Table 3.2 - Levered and Unlevered with tax

Total cash flow to shareholders and bondholders rises by 6.30% due to the advantage of tax-shield. Furthermore, the return on the book value of equity rises by 6.41%.

The rise in total cash flow to shareholders and bondholders (firm value) for a levered corporation is caused by positive gains from carrying debt according to Modigliani and Miller. The value of a levered firm, assuming both taxes and leverage are relevant, follows equation 9,

$$Firm\ Value_L = EBIT * \left(1 - T_c\right) + \frac{T_c r_D D}{r_D} \qquad \text{Eq. 9}$$

(Brealey et al., 2020, p. 477)

Equation 9 emphasises the firm value is equal to the value of an unleveraged corporation plus its tax shield, hence equation 8.

5.3 Leveraged recapitalization

To carry forward the analysis, effects towards investors are investigated. Recall from Table 2.3, the number of implied shares of implied share price, market capitalization, and debt.

Volkswagen plans a hypothetical leveraged recapitalization and issues an announcement with intended acts of a debt-financed share buy-back program. Volkswagen intends to buy back shares for a total amount of €34,042 million. The buy-back program is fully debt-financed assuming a tax rate of 21.00%.

Assumptions carried in the analysis are summarized in Table 3.3,

Assumptions	
Leverred recapitalization	
Implied shares	501.295.000,00
Implied share price	163
MV of equity 2020, millions	81.625
Debt 2020, million	204.158,00
Value of corporation	Equity + debt
Taxes	21,00%
Debt issue	34042

Table 3.3 - Assumptions of leveraged recapitalization

The analysis seeks to understand investor reactions from the point of announcement until the buy-back is finalized. The analysis assumes prior applied propositions of Modigliani and Miller (Modigliani & Miller, 1963, p. 442). Findings of both buy-back announcement and finalized buy-back program are presented in Table 3.4,

Leverred recapitalization			
	Actual	**Increasing debt with 34.042**	
	Leverred - 2020	after buy-back announce.	Finalized buy-back
Shares			
Implied shares	501295000	501295000	309063033
Implied share price	163	177	177
MV of equity	81625	88773	54731
Debt	204.158	204.158	238.200
Value of Company	285.783	292.931	292.931

Table 3.4 - Leveraged recapitalization

The equity rises with a total of €7,148 million initially after the announcement due to upcoming tax-shield gains from the leveraged recapitalization program. Thus, no effects happen towards the implied shares outstanding instantaneously after the announcement. However, the implied share price rises by 8.59%.

Debt from the recapitalization program funds buy-back at the share price of €177. The debt allows purchasing a total number of shares following equation 10,

$$x = \frac{Debt_{Issue}}{implied\ share\ price} \qquad \text{Eq. 10}$$

To summarize, the recapitalization announcement suggests an instantaneous increase in share price caused by upcoming gains due to advantages from carrying debt. When the recapitalization program is finalized, the market value of equity decreases due to fewer shares outstanding. However, the

share price stays constant at €177 as the value of equity decreases by the debt raised. Through the recapitalization program, investors are compensated with capital gains.

The proposed finalized recapitalizations suggest a review of the impact towards total cash flow to shareholders and bondholders presented in Table 3.2.
The reviewed table assumes scenarios of unlevered, levered, and after finalized recapitalization program. Furthermore, the assumption of the cost of debt at 1.12% and taxes at 21.00% remains. Due to greater debt levels, changes in interest expenses and tax expenses occur. Finally, earnings per share (EPS) are calculated under circumstances of implied shares before buy-back announcement and after finalized buy-back. The findings are presented in Table 3.5,

with taxes		**Before buy-back**	**Finalized buy-back**
	Unleverred	Leverred	Leverred
Taxes and cash flow			
EBIT	9.675	9.675	9.675
Interest expenses	0	-2291	-2673,01
EBT	9.675	7.384	7.002
Taxes	-2031,75	-1550,64	-1470,42
EAT	7.643	5.833	5.532
Total cash flow to shareholders and bon	7.643	8124,36	8204,58
Return on equity	5,93%	6,31%	6,37%
EPS		16,21	26,55

Table 3.5 - Buy-back with taxes

The benefit from a leveraged recapitalization indicates a further increase in return on equity as a cash flow to shareholders and bondholders increases. Earnings per share increase correspondingly as more funds are attributable to shareholders and bondholders. Overall value contribution suggests that investor's total wealth is increased in accordance with successful leveraged recapitalization.
It is worthwhile to mention that the new corporate law for tax incentives applies in The United States after 2021. For many reasons, the potential tax-shield to be obtained by corporations in The United States from 2021 is limited to 30.00% of EBITDA (Gravelle, 2020, p. 2) . However, EBIT suggests earnings of €9,675 million. In this case, the possible tax-shield for Volkswagen cannot exceed €2,902.5 million. The proposed leveraged recapitalization program suggests total interest expenses of €2,673 million and does not exceed the limit.

5.4 Unleveraged beta

The final step of analyzing Volkswagen's capital structure focuses on how levered and unlevered operations influence its systematic risk (beta) and required rate of return by investors. To carry out the analysis, an industry approach is implemented for five comparable corporations. Equal risk between compared corporations is assumed. The analysis seeks to split up both operational and financial leverage. Fixed costs are defined as costs that do not depend on and fluctuate approximately linearly with the revenue. Opposite, the cost of sales represents expenses accrued by revenue with an approximately linear relationship.

Beta and debt-to-equity ratio are obtained in Yahoo Finance (2021). The before mentioned are obtained in Yahoo Finance to stabilize congruence between the methodology applied to derive beta and debt-to-equity ratio. Therefore, due to the same source of data, biasness is limited as discrepancies between each corporations' methodology are eliminated.

Fixed-to-variable costs ratios are derived from their respective 2020 annual report. Furthermore, the effective tax rate for each corporation in 2020 is calculated in accordance with the rationale presented in Table 3.5. Finally, it is assumed that debt does not carry market risk. Applied assumptions are summarized in Table 3.6,

Assumptions industry approach	
Beta average	Yahoo Finance
Debt/equity ratio	Yahoo Finance
Effective tax rate	average of industry
Fixed/variable ratio	average of industry
Debt carries no market risk	

Table 3.6 - Assumptions industry approach

Both unlevered beta and business beta for the automotive are derived for the purpose of finding unlevered and levered beta for Volkswagen. An overview of the findings for the industry is summarized in Table 3.7,

Industry companies	Beta	Debt/equity ratio	Tax rate	Fixed/variable ratio
BMW	1,36	1,40	26,14%	0,103
Daimler	1,66	2,34	36,76%	0,113
General Motors	1,39	2,44	21,91%	0,080
Tesla	2,01	0,53	25,30%	0,126
Toyota	0,72	1,10	26,75%	0,229
Volkswagen	1,51	1,32	28,57%	0,151
Industry average	1,44	1,52	27,57%	0,134
Unlevered industry beta	0,69			
Business beta	0,60			

Table 3.7 - Industry comparison

To understand the risk associated with operations within the automotive industry, business beta is derived from average components in the industry of interest.

Findings suggest that operations within the industry have a beta below 1.00, hence less volatile than the market itself.

Thereafter, unleveraged, and levered beta for Volkswagen and each of their cost of equity. Necessary assumptions for this analysis are presented in Table 3.8,

Assumptions for Volkswagen	
Beta	1,26
Debt/equity ratio	1,32
Effective tax rate	28,57%
risk free rate	-0,02
market risk premium	0,075
Debt carries no market risk	

Table 3.8 - Assumptions for Volkswagen

Assumptions for beta, debt-to-equity ratio and effective tax rate remain the same as those applied for the industry approach. Furthermore, Volkswagen published the actual risk-free rate and market risk premium for the annual report of 2020 (Ernst & Young, 2020, p. 129). Relevant assumptions are summarized in Table 3.9,

Assumptions for Volkswagen	
Beta	1,26
Debt/equity ratio	1,32
Effective tax rate	28,57%
risk free rate	-0,02
market risk premium	0,075
Debt carries no market risk	

Table 3.9 - Assumptions for Volkswagen

Finally, the results of both unlevered and levered beta and their corresponding cost of equity for Volkswagen are presented in Table 3.10,

Unlevered Beta of Volkswagen	
Unlevered Beta	0,79
cost of equity (CAPM)	5,50%
Levered Beta of Volkswagen	
Levered beta	1,54
cost of equity (CAPM)	12,59%

Table 3.10 - Unlevered and levered Beta of Volkswagen

Findings suggest that Volkswagen operates with an undiversifiable systematic risk of 0.79 in case operations are unlevered. Due to actual leverage, Volkswagen operates with a systematic risk of 1.54.

The dispersion between unlevered and levered beta provides important information about the risk associated with Volkswagen and has a mutual dependency related to the cost of equity, hence investors required rate of return. The unlevered cost of equity, as a function of CAPM, suggests a required rate of return from investors at a minimum of 5.50%. To compare, the cost of equity in the case of levered business, suggests a substantially higher required rate of return by investors at 12.59%.

The dispersion in the required rate of return emphasizes the influence of leverage. Investors require a greater return on their investment, as the investment carries more risk. While the systematic risk rises, investors demand compensation, thus the required rate of return rises, and vice versa. The rationale is supported by the CAPM, suggesting a linear relationship between risk and return

(Campbell et al., 1996, p. 181). The rationale aligns with the reviewed proposition of Modigliani and Miller suggesting the influence of both taxes and leverage matters (Brealey et al., 2020).

The mutually counterproductive findings highlight important aspects that Volkswagen must pay attention to, in the choice of executing a recapitalization program. In the first part of the capital structure analysis, findings suggest that investors will be compensated with capital gains from a buy-back program of two steps. Firstly, instantaneous after the buy-back announcement, by expected income gains from an additional reduction in corporate taxes and secondly, after finalized recapitalization, from benefits of less shares outstanding.
The second part of the capital structure analysis findings suggests that risk, and hence required rate of return by investors, were minimized in case of unlevered business, and vice versa. Therefore, Volkswagen must recognize that increasing debt is interpreted by investors as an increase of risk. The additional risk obtained by investing in the corporation should indeed be compensated with greater returns as the nature of CAPM implies, hence linear relationship. Therefore, financial distress can occur in case that increased leverage fails to compensate investors with greater returns. Hypothetically, if Volkswagen fails to attract and hold on to existing investors as better risk-return profile investments are available in the market, the demand of Volkswagen shares decrease. In the case of an unsuccessful leveraged recapitalization, Volkswagen will suffer from falling share prices.

6. Discussion & Conclusion

Throughout the project, two main areas within finance were covered. Findings in the fundamental analysis suggested a potential upside in the target share price of 140.00%. Furthermore, the capital structure analysis highlighted the advantage of carrying debt and risk in the automotive industry. However, the fundamental and capital structure analyses excluded topics of interest in relation to both areas. The areas are discussed in the following to point out diverted limitations.

6.1 Fundamental analysis

The fundamental analysis is exposed towards lack of data as the sample period did only consider a sample period of 2016 – 2020. It is acknowledged that more data points would either provide more conservative or optimistic forecasting factors for both income statement and balance sheet. Furthermore, the third financial statement, the cash flow statement, was attributed modest attention,

wherefore neglection of managing short-term cash needs to run the business occurs. Furthermore, the definition of *debt* – interest-bearing debt – can be questioned. The fair value of all of Volkswagen's debt instruments was not calculated and could change the overall forecasted target share price. In regard to the balance sheet, forecasting was limited to be focused on current assets, total assets, current liabilities, total liabilities, and equity. Therefore, several factors were left out of scope. The fundamentals analysis did neither cover unexpected shocks, changes in production and marketing strategy, asset-based valuation, credit status, personnel experience, nature of the competition, maturity of the business and analysis of expected prospect for the automotive industry, which could contribute positively to the analysis

Another important limitation implies the application of an after-tax WACC for the *automotive industry* applied to discount cash flows. It is acknowledged that incorporating Volkswagen's total WACC is more accurate. Into the bargain, Volkswagen's annual report did not provide sufficient information on each division and how debt and equity are distributed between each division. Looking at the derived firm value in Table 2.11, findings suggest that approximately 80.00% of this value is provided by the terminal value. Also, the terminal value depends significantly on the terminal growth and WACC rate as recognized through the scenario analysis. On the contrary, adjusted present value (APV) would probably suggest a different target share price.

6.2 Capital Structure

The capital structure analysis carries several limitations. A reformulated income statement after finalized recapitalization was presented in Table 3.5. The recapitalization program assumed a hypothetical debt-financed share buy-back program with €34,042 million. However, the analysis did not consider financial distress costs when the debt ratio rises. The immediate thought from the presented formula in equation 8, suggests that capital structure matters and corporations are optimally 100.00% debt-financed due to gains from a reduction in corporate taxes. However, this argument conflicts with the presence of financial distress costs suggesting that an optimum in capital structure exists. Into the bargain, to quantify emerging financial distress costs from additional debt level raises two questions. *At what point do the costs occur,* and, *how do the price and evolvement of these costs relate to change in debt levels*. Reliable quantification is rather difficult if not impossible, wherefore it is left out of scope. The trouble occurs in relation to

non-conclusive answers to the optimal debt ratio but rather depends upon several factors. Among others, credit rating, asset composition, profitability, future prospect, size, and life cycle are mentioned in existent literature. Thus, the argument of 100.00% debt-financed operation is neglected due to the new corporate law of tax incentives presented in section 5.3.

Continued, the capital structure analyzed the industry in regard to systematic risk and business beta to derive a better understanding of Volkswagen's business.

A business beta of 0.60 is derived, indicating that the undiversifiable risk by operating within the automotive industry is less volatile than the market. However, only 5 comparable corporations were applied in the industry approach. As the sample size grows, errors are minimized and therefore, due to a limited number of corporations, the findings are questionable.

Furthermore, the effective annual tax rate follows the rationale presented in Table 3.5. The corporation's origin from different countries and must apply to different tax laws with divergent tax rates. It is recognized that a stabilized environment is difficult to set in place while comparing the industry.

Finalizing the area of capital structure, the cost of equity for Volkswagen in case of both unleveraged and leveraged operation. The suggested unlevered and levered beta, and its corresponding cost of equity does only reflect data points from 2020. It is naive to believe that only considering data from 2020 will provide unquestionable results. Into the bargain, the values did provide useful understanding but were not applied for any forecasting, thus the findings are limited to be understood for the year 2020. Therefore, development and validity are debatable.

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Missing:

- Campell