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The Long-Term Investment Perspective - Assessing Volkswagen AG intrinsic value

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Master (MSc) in Finance

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PhD Pedro Manuel de Sousa Leite Inácio, Assistant
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ISCTE-IUL

January, 2023



**BUSINESS
SCHOOL**

Department of Finance

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*Do the one thing you think you cannot do.
Fail at it. Try again. Do better the second time.
The only people who never tumble are those who never mount the high wire.
This is your moment.
Own it.*

Agradecimentos

A entrega desta dissertação representa um marco importante na minha vida, fechando oficialmente, para já, a minha jornada de estudante. Apesar dos altos e baixos, dos sacrifícios e proveitos, foi uma caminhada bastante enriquecedora que tive todo o gosto de experienciar.

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Resumo

O âmbito desta dissertação contempla a avaliação dos capitais próprios da Volkswagen AG, uma das maiores empresas de produção automóvel do mundo. Foram vários os motivos que levaram à escolha desta empresa. Em primeiro lugar, analisar como as empresas automóveis ajustam os seus modelos de negócio de modo a acomodar as constantes mudanças e inovações da indústria é bastante interessante. Do mesmo modo, é também interessante perceber como a empresa ultrapassou o recente escândalo do Dieseldate e ainda assim consegue continuar como uma das maiores empresas na indústria.

Sendo assim, o principal objetivo foi a obtenção de uma recomendação de investimento baseada em certas metodologias de avaliação de empresas. Esta recomendação baseou-se num modelo de avaliação intrínseca, através do método DCF, e numa metodologia de avaliação relativa, através dos múltiplos do mercado. Para além das metodologias acima descritas, o Three-Statement Model, o Modelo de Regressão Linear Múltipla e o Option Pricing Method foram também abordados.

Para averiguar a precisão dos pressupostos levados a cabo na avaliação, foram também analisadas estimativas de preço de outros analistas.

Foi deduzido um valor intrínseco de 194.04 EUR para ambas as ações da empresa, ações ordinárias e ações preferenciais, o que implica que o mercado estava sobreavaliando as ações ordinárias e a subavaliando as ações preferenciais a 31 de Dezembro de 2021. Como resultado, é recomendada a venda das ações ordinárias e a compra das ações preferenciais da empresa.

JEL Classification: G30, G32

Keywords: Volkswagen AG, Avaliação Intrínseca, Avaliação Relativa, Three-Statement Model, Multiple Linear Regression Model, Option Pricing Method

Abstract

This master project focuses on the equity valuation of Volkswagen AG, one of the major automotive companies in the world. Volkswagen AG was the chosen company due to a variety of factors. Firstly, it is interesting to analyze how automotive companies should adjust their business models to accommodate the ongoing changes and innovations within the industry. Additionally, it is intriguing how the company overcame the Dieselgate scandal and is still one of the biggest players in the industry.

The main objective of this research is to provide an investment recommendation based on certain investment valuation techniques. The decision will be based on an intrinsic valuation approach, the DCF using FCFE, and on a relative valuation approach, through market multiples. Alongside with the valuation techniques used, the Three-Statement Model, the Multiple Linear Regression Model and the Option Pricing Method were also applied.

In order to assess the accuracy of the assumptions made, other analysts' estimates were taken into consideration.

An intrinsic price of 194.04 EUR was deduced for both shares, which implies that the stock market was overvaluing ordinary shares and undervaluing preferred shares on 31st December 2021. As a result, a sell recommendation for ordinary shares and a buy recommendation for preferred shares were gathered, since it is expected that the market will amend both margins, by naturally decreasing or increasing the price of share, respectively.

JEL Classification: G30, G32

Keywords: Volkswagen AG, Intrinsic Valuation, Relative Valuation, Three-Statement Model, Multiple Linear Regression Model, Option Pricing Method

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List of Abbreviations

APP : Asset Purchase Program
BR : Brazil
CAGR : Compound Annual Growth Rate
CAPM : Capital Asset Pricing Model
CHI : China
COVID-19 : Coronavirus Disease
CIP : Consumer Index Prices
D : Debt
DAX : Deutscher Aktienindex index
D&A : Depreciation and Amortization
DCF : Discounted Cash Flow
DDM : Dividend Discount Model
EBIT : Earnings Before Interest and Taxes
EBITDA : Earnings Before Interest, Taxes, Depreciation and Amortization
EBT : Earnings Before Taxes
EMDE : Emerging market and developing economies
EQV : Equity Value
ERP : Equity Risk Premium
ESG : Environmental, social, and corporate governance
EUR : Euro currency
EV : Enterprise Value
EV/EBIT: Enterprise Value-to-EBIT
EV/EBITDA : Enterprise Value-to-EBITDA
FCEV : Fuel cell vehicle
FCFE : Free Cash Flow to Equity
FCFF : Free Cash Flow to the Firm
FY: Fiscal Year
GDP: Gross Domestic Product
GER : Germany
INF : Inflation
 k_d : Cost of Debt
 k_e : Cost of Equity
ND : Net Debt
NTM: Next Twelve Months

NWC : Net Working Capital
OIL AVG. : Oil average prices
OPM : Option Pricing Model
P/BV : Price-to-Book Value
P/E : Price-to-Earnings
R&D : Research and Development
SWOT: Strengths, Weaknesses, Opportunities, and Threats
SXAE : EURO STOXX Automobiles & Parts Index
TTM : Trailing Twelve Months
TV : Terminal Value
USA : United States
Volkswagen : Volkswagen AG or Volkswagen Group
VOWG.DE : Volkswagen's ordinary shares
VOWG_p.DE : Volkswagen's preferred shares
WACC: Weighted Average Cost of Capital
WC : Working Capital
YoY : Year-on-Year
YTM: Yield-to-Maturity

CHAPTER 1

Introduction

Given today's social trends, an increasing number of people are thinking about financial independence and early retirement. Unfortunately, for most people, the income from work is not enough to meet these new social tendencies and the necessity to search for alternative sources of income increases. Among several alternatives, investing in financial markets is one of the most accessible ways to try to make money.

It is important to bear in mind that investing does not only have benefits – when investing, investors face risks (of losing part or their entire investment) and professional competition (such as hedge funds and other institutional investors) and they have to be emotionally balanced (stock prices behave like a roller coaster, they climb and fall every second – and investors have to maintain their emotions to do not be influenced by these market fluctuations).

Motivated by this and by what the author wants to do in the future, this master's project will approach the concept of fundamental analysis which the author considers to be the most reliable within the scope of well-known investment strategies – because it is based on a deep analysis of the business and its inherent risk is much lower when compared, for example, with technical analysis. This strategy highlights stocks that are undervalued by the market, this is, a stock that is traded on the market below its intrinsic value. The difference between the stock price and its intrinsic value is the margin of safety. Investors who pursue this strategy believe that, at a given point in time, the stock market will accurate the stock price to its intrinsic value and is with this movement that those investors make profits.

Volkswagen was the chosen company to be analyzed. There were two main reasons to choose this company. To begin, given the ongoing changes and innovations brought about by globalization and technology, it was crucial for me to understand the automotive industry's future. If electric vehicles and mobility firms without vehicles (such as Uber) were unthinkable a few years ago, the primary trends in this market now are self-driving vehicles and shared mobility. With this in mind, it is both tough and intriguing for the author to comprehend how the companies in this industry will adapt to these new developments. Furthermore, Volkswagen was chosen in this industry because he wanted to figure out how this company managed to overcome the Dieselgate scandal in a highly competitive industry and in a reality in which the care for sustainable factors weighs more and more on people's daily lives, and yet it continues to be one of the largest groups in the history of the automotive industry.

The German automobile company was founded in 1937 and has its headquarters in Germany. The company manufactures and sells passenger cars and light commercial vehicles, as well as develops vehicles and components for the group's other brands, operating through the following segments: passenger cars, commercial vehicles, power engineering, and financial services.

The primary goal of this research is to evaluate the company's fair value and establish if the stock market is over or undervaluing the company. Throughout the literature review, valuation methodologies will be thoroughly examined in order to find and decide on the appropriate approach to evaluate Volkswagen. Following that, internal and external qualitative information, such as the macroeconomic and industry prospects, as well as the company's overview, will be evaluated. Following that, financial statements will be estimated. Finally, in chapter 8, the valuation methodologies will be conducted, and in chapter 9, an investment choice will be made. This decision will be between buying if the stock has a margin of safety of more than 10 percent, selling if the stock is more than 10 percent overpriced, and holding if the stock remains between an upward potential of 10 percent and a downside potential of 10 percent.

To conclude, it is important to be aware that this investment strategy takes time to reach its potential. The lesson is that historical returns do not guide future performances, they are only a mere indicative to understand a business. Markets are unpredictable and the concept of "getting rich quickly" is just an illusion, there is no such thing. Therefore, to invest, not only do we need knowledge about the markets, but we also need to be emotionally stable and let the market show the rationale behind our investments.

"No matter how great the talent or efforts, some things just take time. You can't produce a baby in one month by getting nine women pregnant."
(Warren Buffet)

CHAPTER 2

Literature Review

Throughout this chapter, it will be analyzed the main guidelines to conduct a business valuation, by presenting and analyzing the major investment valuation strategies. However, it is important to note that, given the extension of this research, some concepts will be only briefly covered in the Appendix Chapter, such as the Multiple Linear Regression Model (the method used to estimate the sales revenue in the Three-Statement Model Chapter) and the Option Pricing Method (the approach used to efficiently allocate equity value through the different equity instruments).

2.1. Introduction to Investments

Dave Ramsey wrote, “Financial peace is not the acquisition of stuff. It is learning to live on less than you make, so you can give money back and have money to invest. You cannot win until you do this”. As important as knowing how to earn an income is knowing how to manage it. The days when account savings were the popular and safer way to save or build wealth are gone. Investing is an effective way to put money to work and potentially build wealth.

Undeniably, there are people that are not so comfortable with the concept of investing due to its risk. However, it is important to point out that there are securities safer than others, and the key driver to be successful in investing is to do a rigorous evaluation of what we are buying – “know what you own, and know why you own it” (Peter Lynch, 2000 [23]).

There are several different approaches to the way investors can conduct their investment strategy. Fundamental analysis and technical analysis are the two major well-known investment strategies.

Fundamental analysis is a holistic approach to assessing the intrinsic value of a company through the evaluation of various features, such as macroeconomic and microeconomic factors, the company’s business, its industry, and its financial statements, among others. Usually, fundamental investors are long-term investors, and therefore, it is extremely crucial to understand the whole business from every perspective.

The output of this analysis is to figure out the intrinsic value of the security that will serve as the guide to pursue the investment strategy or not.

On the opposite of fundamental analysts, we have technical analysts that aim to short-run profits. Technical analysis focuses on forecasting a security’s price movements – technical investors use charts to identify patterns and trends that they expect will repeat over time to make profits from there. It is defended by many investors that wealth is only

created through intelligent long-term investments. Illustrated by Graham et al. (2015) [1], investors judge “the market price by established standards of value”, whereas speculators “base (their) standards of value upon the market price”, arguing that “people who invest makes money for themselves; people who speculate make money for their brokers and pay taxes which in turn share profit with governments.”

2.2. Company Valuation

The key purpose of a company is to maximize its value. But how can a stakeholder measure value? Valuation plays a key role in finance because it provides prospective buyers with an idea of how much they should pay for an asset or company and for prospective sellers, how much they should sell for. Analyzing a company’s quantitative and qualitative data is one technique to determine its value.

Quantitative information, such as financial metrics or key performance indicators, is designed to track, measure, and analyze the financial health of a company. However, a company’s performance cannot be measured only by looking through numbers, there is a lot of qualitative information (soft factors) that could influence some investment decisions even more than quantitative data. Soft factors comprise all external and internal factors that could influence the business performance, such as the company’s strategies, competitors, industry and macroeconomic environment, and risks and opportunities.

By fitting together both kinds of information, it is possible to reach an accurate estimate of the company’s value through valuation methods. Business valuation plays a key role in the finance world, and it is the central focus of fundamental analysis.

2.3. Intrinsic Valuation - Discounted Cash Flow Approach

Pinto et al. (2020) [29] describes the Discounted Cash Flow method, DCF, as a valuation technique that estimates the intrinsic value of an investment based on expected future cash flows discounted to the present. According to Gup et al. (2010) [18], this is the most effective method since it is based on cash flows originating from the balance sheet and income statement, considers the opportunity cost of capital and reflects the time in which the cash flows are clearly predicted. In addition, this strategy underpins a range of relevant information, including the status of the economy, interest rate levels, firm-specific financial situation, and market sentiment.

The DCF method appeared at least in the early 1700s in the UK coal industry, and according to Luehrman (1997) [25], it has been the mainstream for the past 20 years, being recognized as the most accurate and broadly applied in business valuation by many writers, including Fama et al. (2004) [13], Damodaran (2012) [9], Fernandez (2013) [15], and Koller et al. (2015) [21].

Although there are literally hundreds of DCF models available, they can only differ in a few features, the cash flow and the interest rate (Damodaran, 2012 [9]).

The DCF method follows the same two-step approach defended by Luehrman (1997) [25]:

$$Value = \sum_{t=1}^N \frac{FCF_t}{(1+r)^t} + \frac{TV}{(1+r)^N} \quad (2.1)$$

The discount rate, r , is considered a function of the riskiness of the estimated cash flows, thus lower rates for safer assets and higher rates for riskier ones (Damodaran, 2012 [9]). The free cash flows, FCF, are the amount of cash that would be earned through the lifetime of the investment, and since it is unfeasible to forecast the cash flows throughout the entire time of the investment, a terminal value, TV, is approached. The bigger the number of years for which cash flows are anticipated, the greater the complexity and loss of accuracy of the projections; hence, the time horizon used in this model should be between 5 and 10 years.

According to Damodaran (2012) [9], a perfect valuation model does not exist, which indicates that every model contains flaws. Although the DCF method is the most accurate and flexible method to assess the company's value, the huge dependency of the model on its parameters - such as the time horizon, the estimated free cash flows, the discount rate, and the growth rate (that will be addressed later in the Terminal Value chapter) - makes its accuracy DCF models largely reliant on the values estimated as defended by Koller et al. (2015) [21].

2.3.1. Free Cash Flows

There are numerous potential streams of predicted cash flows in the DCF approach, depending on the nature of the cash flows, which results in the formation of several modifications of the Discounted Cash Flow valuation model. The Dividend Discount Model (DDM) cash flow, the Free Cash Flow to Firm Valuation (FCFF) and the Free Cash Flow to Equity Valuation (FCFE) are the three kinds of FCF that are going to be approached in this subsection.

Free Cash Flow to the Firm (FCFF)

Koller et al. (2015) [21] showed the reliance and preference on the Free Cash Flow to the Firm, FCFF, method as the favorite method for professionals and academics because it relies uniquely on the cash flow. This first method evaluates a business through the following expression:

$$EnterpriseValue(EV) = \sum_{t=1}^N \frac{FCFF_t}{(1+WACC)^t} + \frac{TV}{(1+WACC)^N} \quad (2.2)$$

By subtracting the then-existing value of debt, the equity value is obtained (Bodie et al. (2018)):

$$EquityValue(EQV) = EV - FinancialDebt + Cash\&CashEquivalents \quad (2.3)$$

In point of fact, this approach ignores how the company is financed – it estimates the free cash flow at the operating level, before debt payments (Damodaran, 2012 [9]; Mota et al., 2012 [26]; Fernandez, 2013 [15]).

Clayman (2012) [7] defines free cash flow to the firm as the operational cash flow, that is, the cash flow generated by operations net of debt (financial debt), after tax. In other words, it is the after-tax, t_c , amount of money that would be left in the firm after covering fixed asset investments, CapEx, working capital requirements, WC, ignoring non-cash operational expenses (such as depreciation and amortization, D&A) and assuming no debt and hence no financial expenditures. As Damodaran (2012) [9] shows:

$$FCFF = EBIT(1 - t_c) + DA - CapEx - \Delta WC \quad (2.4)$$

In addition, FCFF may also be calculated in another way, by summing up the cash flow from all claim holders, as advocated by Koller et al. (2015) [21] - the FCFF is the "cash accessible to all investors—equity holders, debt holders, and any other non-equity investor." It begins with free cash flows to equity, FCFE, then proceeds to lenders (principal repayments, interest expenditures, and fresh debt issuance), and finally to preferred stockholders (preferred dividends):

$$FCFF = FCFE + InterestExpenses(1 - t_c) - NetBorrowings \quad (2.5)$$

Owing to the fact that this method relies on cash flow available to all suppliers of capital, before paying the expenses to debt holders, the value of these cash flows is discounted at the weighted average cost of capital, WACC (Pinto et al., 2020 [29]). Finally, even though the cash flows are prior to debt payments and do not expressly mention debt tax advantages, these benefits are integrated into the discount rate (Damodaran, 2012 [9]; Koller et al., 2015 [21]).

Free Cash Flow Equity (FCFE)

The Free Cash Flow to Equity, FCFE, evaluates the equity value through the following method:

$$EquityValue(EQV) = \sum_{t=1}^N \frac{FCFE_t}{(1 + k_e)^t} + \frac{TV}{(1 + k_e)^N} \quad (2.6)$$

The FCFE is the amount of cash left over to shareholders after covering fixed asset investments and working capital needs, as well as paying the financial charges equivalent to a portion of the debt's principal (Fernandez, 2019 [16]).

$$FCFF = EBIT(1 - t_c) + Depreciation - CapEx - \Delta WC - NetBorrowing \quad (2.7)$$

Additionally, FCFE can also be determined through FCFF by removing the after-tax interest and principal payments paid to debt holders in each period and adding the new debt issued.

Given the fact that these cash flows are only distributed to shareholders, their value is discounted at the cost of equity, k_e .

Although the main idea of this approach is that the FCFE equals the value of cash flows paid to shareholders in the form of dividends, that does not imply that firms distribute all of this value in the form of dividends (Damodaran, 2012 [9]). The major reasons are connected to the fact that firms seek a stable dividend policy, meaning that earnings are more volatile than dividends payments (Brav et al., 2005 [5]), and holding extra cash might be useful to cover future capital costs (Damodaran, 2012 [9]).

Dividend Discount Model (DDM) cash flow

The Dividend Discount Model, DDM, uses the estimated dividends as a proxy for the cash flow in the DCF framework. This model is the simplest and oldest DCF method and since it only considers cash flows that are actually paid out to stockholders is viewed as the most conservative way of valuing a stock (Damodaran, 2012 [9]).

The DDM assumes that the equity value of a company corresponds to the present value of the perpetual stream of future dividends, D , and a final terminal value at the required rate by shareholders, as shown in the formula below:

$$EquityValue(EQV) = \sum_{t=1}^N \frac{D_t}{(1 + k_e)^t} + \frac{TV}{(1 + k_e)^N} \quad (2.8)$$

Similarly, to FCFE, since the dividends are only distributed to shareholders, the present value of the dividends is calculated using the cost of equity, k_e .

The dividend method is frequently criticized for its shortcomings, which can easily lead to an inaccurate valuation: firstly, the corporation must pay dividends; secondly, the model requires a lot of assumptions such as a growth rate, a required rate of return, and a tax rate, assuming that profits and dividends are always linked, what is not true; additionally, the model also excludes the effects of stock buybacks, which can have a considerable impact on the amount of stock value returned to shareholders.

2.3.2. Interest Rates

Discount rates indicate the time worth of money and reflect the risk connected with cash flows - the higher the risk associated with a cash flow, the higher its discount rate should be (Damodaran, 2007 [10]).

All investors (equity and debt holders) expect a return on their capital that accounts for the risk taken and the time value of money (Berk et al., 2016 [3]). Because debt holders bear less risk than equity holders, they should get different returns and, as a result, every cash flow should be discounted at a proper rate.

Weighted Average Cost of Capital (WACC)

The enterprise DCF method requires the forecasted FCFF to be discounted at the Weighted Average Cost of Capital, WACC. The WACC expresses the expected and necessary return for all investors (shareholders and lenders) for engaging in a business with similar risk. This cost is also referred as the long-term opportunity cost of the invested funds faced by investors (Koller et al., 2015 [21]).

It incorporates concepts such as the nominal risk-free investment rate, which results from not investing in risky alternatives, the risk premium, which reflects the return for the extra risk investors are willing to take (that depends on investors' risk profile), and the interest tax shield, by being a tax-adjusted rate. In addition, three variables are highlighted in this formula that should be computed separately: the after-cost of debt, the cost of equity and the capital structure. The first two are difficult to estimate since they are not directly observable (Damodaran, 2012 [9]).

$$WACC = \frac{E}{E + D} \times k_e + \frac{D}{E + D} \times k_d \times (1 - t_c) \quad (2.9)$$

In this method, gross debt is used which is a common way to calculate WACC when there is not a huge amount of cash on the balance sheet. On the other hand, when the company has accumulated a lot of cash, the net debt method gives a more accurate WACC as it deducts the cash from the debt outstanding. In this case, the cost of equity will have more weight in the calculation. In order to get the most punctual discount rate, we could introduce another factor next to debt and equity which is preferred equity. Regarding the debt value, it will only be considered interest-bearing debt (both long-term and short-term debt).

Some may question why we use market values instead of book values in the computation of the weights for equity and debt. Damodaran (2012) [9] gave us the answer to this by explaining that we use market values “because the cost of capital measures the cost of issuing securities – stocks as well as bonds – to finance projects and these securities are issued at market value, not at book value”.

The advantage of WACC is that it simplifies the changes in the company's financial mix by assuming a constant capital structure for the future when discounting future cash flows (Damodaran, 2012 [9]). However, this comes with a price, because it is only suitable for firms that preserve a stable capital structure (Luehrman, 1997 [25]). If a change is expected, instead of using the company's current capital structure it should be used the target one (Pinto et al., 2020 [29]).

Cost of Debt (k_d)

The cost of debt, k_d , is the effective rate a company pays to its debt holders. Generally, it is calculated on an after-tax basis, as the interest payments are tax-deductible expenses, creating a tax shield for the company. There are different ways to compute k_d depending on the characteristics of the company (Koller et al., 2015 [21]).

If the company subject to analysis, has publicly traded debt, the computation of the cost of debt is based on the average yield to maturity, YTM, of its outstanding debt. According to Koller et al. (2015) [21] to get the most accurate estimation, the YTM used should be on liquid, option-free and long-term debt. This method is the most used when the company has a simple capital structure and does not have multiple tranches with different characteristics.

If the company does not issue public debt in a consistent manner, analysts should use the company's debt rating in order to achieve a more honest estimation of the YTM.

To conclude, in the case of a non-listed firm, Damodaran (2001) suggests that a reasonable estimate for the cost of debt is to compute the interest coverage ratio, which concerns the recently borrowed funds.

Cost of Equity (k_e)

The cost of equity, k_e , is the expected return that equity investors expect to receive. In the middle of several models to estimate the cost of equity, Koller et al. (2015) [21] highlighted the three main ones: the Capital Asset Pricing Model, CAPM, a risk-return model, developed by Sharpe in 1964 and reinforced by other authors, was built based on the model of portfolio choice created by Markowitz in 1959; the Asset Pricing Theory, built by Stephen Ross in 1976; and a three-factor model approached by Fama and French in 1992, which was an upgrade of the single-factor model CAPM.

Although Fama and French considered the model as an empirical failure, several studies such as the one made by Bruner et al. (1998) [6] showed that the CAPM is the most known and widely used model. The model's simplicity, intuitive appeal, and lack of improvement in more complex models are what give this model the preference of choice among investors.

Bearing in mind that investors are risk averse as such, their main objective is to minimize variance and maximize the portfolio return. The CAPM linearly relates the firm's cost of equity (expected return) and the firm's beta (firm's systematic risk), in a regression of the firm's equity returns on a market index.

$$k_e = r_f + \beta \times (E(r_M) - r_f) \quad (2.10)$$

This model is based upon three assumptions: there are no taxes nor transaction costs and investors can lend at a risk-free interest rate; the rational investor has the goal to maximize his investment; and, the market is efficient, there is no asymmetric information (Berk et al., 2016 [3]).

The risk-free rate, r_f , is the expected return on investment without risk (Oded et al., 2007 [27]). Damodaran (2012) [9] defined the risk-free asset as an asset without default risk nor reinvestment risk. Regarding the default risk, government bonds are used since the government controls the printing of money, and thus, there is no default risk. On

the other hand, to avoid the reinvestment risk, the duration matching strategy should be applied, matching the duration of the cash flows with its maturities.

In addition, the government bond should be selected by taking into consideration the currency in which the cash flows are being valued. Koller et al. (2015) [21] recommend the use of 10-year German government bonds due to having lower credit risk (having in mind that just because they are from the government does not mean they are not risky) and due to their liquidity (the most frequently traded bond in Europe).

The equity risk premium, $E(r_M - r_f)$ represents the additional return that investors demand in order to hold equities rather than risk-free assets, being the difference between demanded return on equities and the risk-free rate (Pinto et al., 2020 [29]; Pratt, 2014 [28]).

Damodaran (2020) [11] points out three different methods to measure it: survey subsets of investors and managers to get a sense of their expectations about equity returns in the future; compare past returns on equity with riskless investments and utilize that historical premium as the required rate; and estimate a forward-looking premium based on the market rates or prices on traded assets today and categorize these as implied premiums. In the middle of all approaches, Schill (2013) [30] concludes that the historical average realized returns is the most common method.

The beta, β , measures how much risk the investment adds to the market portfolio (the premium to compensate for the systematic risk of the investment) and illustrates the sensitivity of the stock to the market. The higher the beta, the more sensitive is the company to changes in market conditions and the inverse. A value closer to 1 highlights that the company's stock return behaves very similarly to the stock market.

Although the importance that beta has in the calculation of the cost of equity, the process to estimate the beta is not standardized (Gilbert, 1990 [17]). Damodaran (2012) [9] highlighted three different ways to estimate beta: based on historical data on market prices, through market fundamentals, and by using accounting data. Usually, historical data on market prices are approached when firms that have been publicly traded for a long time are evaluated and market fundamentals when firms that are not publicly traded or recent publicly traded companies are evaluated.

Basically, using fundamentals, the idea is to start by considering the average beta of the industry where the company is incorporated, given that the operating risk should be relatively the same for all. However, the operational risk is not the only risk, the financial risk, where debt is considered, is equally important. As a result, levered beta, β_l , and unlevered beta, β_u , should be distinguished. In order to distinguish both betas, the industry's capital structure should be estimated too. After estimating all parameters, the first step is to compute the industry's unlevered beta and then, apply the specific company's capital structure to that unlevered beta to estimate the company's levered beta (Damodaran, 2012 [9]). The levered and unlevered beta are computed as follows:

$$\beta_l = \beta_u \times \left(1 + (1 - t_c) * \frac{D}{E}\right) \quad (2.11)$$

On the other hand, when historical data on market prices are used, the market model is applied to estimate the company's beta. In this approach, the stock's return is regressed against the market's return, as follows:

$$r_j = \alpha + \beta_L r_m + \epsilon \quad (2.12)$$

2.3.3. Terminal Value and Growth Rate

Since the life of a firm is not expected to be finite, it is impractical to estimate cash flows forever and so, an estimation of the cash flows to perpetuity (the terminal value, TV) is needed. Following Damodaran (2012) [9], it is possible to compute the terminal value using three different methods. Applying a market multiple is one way to estimate the terminal value, however, this approach makes the valuation lose the DCF properties. The second approach is to calculate the value using a liquidation value, which is done by assuming that the business ends in the terminal year and its assets are liquidated at that time, but this method is also quite unreliable because the terminal value would equal the value of the sale of the assets, and it does not translate the earning power of assets. Finally, through the Gordon Growth Model, it is possible to compute the terminal value assuming that the cash flow will grow at a steady pace in perpetuity (Young et al., 1999 [31]):

$$TV_n = \frac{FCFF_n(1 + g)}{r - g} \quad (2.13)$$

The perpetual growth rate, g , should depend on how much the company reinvests for future growth and on the quality of those investments (Damodaran, 2012 [9]). Companies that reinvest higher amounts of cash and consequently, get higher returns on those investments, should have higher growth rates.

Those growth rates are also highly dependent on the life stage of the business cycle. When companies reach their mature phase, they lose their ability to sustain high growth rates and move towards to a stable-growth phase (Fernandez 2007 [14]).

One of the key assumptions is that the perpetual growth rate should not be superior to the economy where the firm operates and that it has a stable growth of earnings, free cash-flows, dividends and residual income (Levin et al., 2000 [22]).

Of all inputs in a valuation, the growth rate is the variable with the major impact on it (Young et al., 1999 [31]). Small changes in the growth rate can lead to significant changes in the terminal value. Therefore, because the assumptions for the terminal value are highly sensible, it is indispensable to compute a sensitivity analysis of the two parameters – discount rate and stable-growth rate – to have an idea of how it impacts a firm's value.

2.4. Relative Valuation - Multiples Approach

Relative valuation is driven by market multiples. Based on the assumption that stock prices have on average captured all relevant information in an efficient market framework, it is possible to estimate the asset's price in comparison to its peers (Liu et al., 2002 [24]).

The first step is to select a peer group (a range of similar companies), which is the most significant and difficult component of this technique.

One strategy is to form a peer group through the firm's properties: select companies in the same industry because they will have comparable risk profiles and, as a result, similar capital costs, size, growth, risks, diversification levels (which are the number of business segments in which the firm operates) and financing constraints (Albuquerque 2009 [2]).

One other approach is to achieve a peer group through statistical methods. Through a regression estimation, it is possible to develop a model that incorporates the important theoretical drivers of growth, risk, and profitability, being the selected multiple the dependent variable and the firm's characteristics the explanatory ones (Bhojraj et al., 2002 [4]). However, Damodaran (2007) [10] claims that there are limitations when using this statistical technique. Applying the regression technique to multiples may result in odd results because the distribution of multiples' values across the population is not normal, and it is possible that the variables used as explanatory variables are not as independent as they are supposed to be.

The next step is to choose the appropriate multiples, which define a common variable needed for valuation.

Multiples are financial measures that are standardized by a common variable and are used to assess a company's performance in a variety of ways. They are either based on earnings, book value or revenues. For some multiples, the current values are applied and for others, forward values are used. Forward-looking multiples tend to predict better pricing results, since it uses next-year estimates that better represent the reality, according to Koller et al. (2015) [21].

Since the obtained values are likely to be different using different multiples, deciding which multiple to use can make a big difference in the estimate. According to Damodaran (2012) [9], from a conventional multiple approach, analysts should use a specific sector multiple. For cyclical manufacturing companies, which is the case of Volkswagen, P/E multiple (Price-to-Earnings) should be used. The Enterprise Value to EBITDA (EV/EBITDA) and the Enterprise Value to Sales (EV/Sales) are other commonly used multiples.

After having the final peer group and the chosen multiple, it is needed to compute the median or the average value of the sample and multiply it by the multiples' indicator. For example, in the P/E case, the median or average value should be multiplied by the company's net income.

Following this process, the analyst should be able to determine a reasonable price for the company's equity or enterprise value.

Relative valuation is easier to use and interpret however, it can be tricking. First, this method can be conducted with far fewer explicit assumptions and far more quickly which can result in unreliable estimates since key variables such as risk, growth, or cash flows are ignored. Secondly, its simplicity and easiness to present to clients and customers make them particularly vulnerable to manipulation once they can carry some lack of transparency regarding the underlying assumptions. Finally, it relies too much on the current mood of the market which can mislead the valuation – bull markets produce overvalued prices and bear markets produce undervalued prices (Berk et al., 2016 [3]).

2.5. Conclusion

Both approaches, intrinsic and relative valuation, have advantages and drawbacks. Market Multiples are just a simplified version of Discounted Cash Flow: the major difference is that the fundamental indicators are implied when using relative valuation whereas they are explicitly estimated with DCF. Overall, it is possible to conclude that, although its major complexity, the deeper explanation behind the DCF makes this method the most reliable one. As Aswath Damodaran wrote, “If good investors buy businesses, rather than stocks (the Warren Buffet adage), discounted cash flow valuation is the right way to think about what you are getting when you buy an asset.”.

To conclude, it is important to point out that price is different from intrinsic value. The former arises from the markets’ behavior: the relation between supply and demand, that incorporates market influences. The latter flourishes from the business’s performance.

Wrapping up these two values, it is possible to conclude about the investment decision and its profitability. The investment decisions are divided between buy, sell or hold: if the market value is below its intrinsic value, investors buy the stock in the expectation that the market is undervaluing it and the price will grow; when the market value is above its intrinsic value, they sell the stock once the bullish market that is overvaluing the stock and in the future the stock will go down; when the values are the same, it is indifferent to investors to buy or sell the stock. Having in mind the efficient-market hypothesis, investors believe that the market sooner or later will accurately reflect the precise value of the business.

CHAPTER 3

Methodology

In order to correctly prepare the valuation of Volkswagen, external and internal factors are going to be looked at in the first chapters of this research. As a result, soft factors such as the macroeconomic and industry environment and the company's strategic plan are going to be analyzed.

In this sense, chapter 4 will address the main macroeconomic indicators that drive the economy, chapter 5 will assess the industry's historical performance and the drivers for the future of the industry, and chapter 6 will provide an overview of the company.

After having all the necessary qualitative inputs, it is time to look at the historical performance of the company to estimate future performance. Therefore, in chapter 7 a Three-Statement Model will be done by forecasting and balancing financial statements from 2022 until 2027. This section will handle financial modeling insights, such as the Three-Statement Model and the Revolving Credit Facility method, and Quantitative Methods insights, such as the Multiple Linear Regression Model to estimate the sales revenue.

Chapter 8 will highlight the company's valuation through intrinsic and relative valuation. Intrinsic valuation will be presented through DCF using FCFF to estimate the Enterprise Value and, subsequently, the equity value. Given the huge reliance of this model on some factors, such as the beta of the company and the perpetual growth rate, a sensitivity analysis will be done to estimate the effect of changes in these parameters. Additionally, the DCF through FCFE and the DDM models are going to be also calculated. Regarding relative valuation, the multiples forward P/E, EV/EBITDA and EV/Sales are going to be used to compute the value of the company.

Finally, in Chapter 9 will be presented the conclusions of the investment decision and the obtained results are going to be compared to other analysts' estimates.

CHAPTER 4

Macroeconomic Outlook

Several economic improvements occurred in 2021. The economy rebounded from the pandemic's first quick decline and massive job losses. However, significant effort was required to keep the economy going ahead and to develop a truly inclusive system. To better understand the influence of such variables on Volkswagen's performance, a broad assessment of the global outlook in 2021 will be presented first, followed by an analysis of the economic outlook of Volkswagen's three primary markets: Europe, the United States, and China.

According to the International Monetary Fund (IMF), global growth reached 5.8 % in 2021 as a result of the easing of pandemic-related limitations in many countries, which aid in stimulating demand. Despite this yearly growth, the pandemic and severe supply bottlenecks weighed heavily on global activity in 2021.

Furthermore, emerging market and developing economies (EMDEs) recovered at a slower and more unstable pace than advanced economies due to slower vaccination advances, a more restricted policy response, and the pandemic's scarring effects. These scarring effects on potential productivity represent the pandemic's negative impact on EMDE physical and human capital. The epidemic undid many years of income improvements in these most vulnerable nations.

The pandemic emphasized how connected the globe is right now. Multiple bottlenecks have affected global supply networks, resulting in global inflationary pressures and higher prices for tradable products. Labor shortages and stronger border controls have hampered manufacturing and delayed the movement of commodities because of lockdowns and restrictions. Furthermore, the pandemic had an impact on customers' behavior. With the pandemic, online shopping also soared, and the kind of things purchased changed: purchases of home office equipment and consumer gadgets increased dramatically. This rising demand required the operation of more ships which resulted in overheating and over-demand, particularly at ports. As a result, lengthy traffic congestion occurred, resulting in lengthier delivery times.

Global energy prices also surged in the second half of 2021, particularly for natural gas and coal, owing to recovering demand and constrained supply. Meanwhile, non-energy commodity prices have leveled off, with some at or close to record highs. After a rapid increase earlier in the year, global commerce has leveled down, owing to slowing demand for traded commodities and supply constraints caused by the pandemic-related factory and port closures, weather-related logistical challenges, and shortages of semiconductors and shipping containers. As a result of these obstacles, as well as the rebound in global

demand and rising food and energy costs, global consumer price inflation and its near-term forecasts have risen more than previously expected, ending 2021 with a consumer index price of 4.7%.

4.1. Euro Area

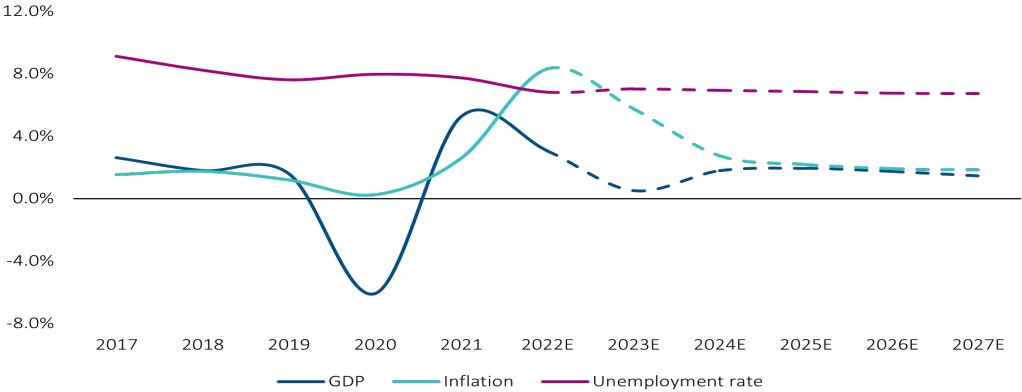


FIGURE 1. Euro Area Macroeconomic Outlook, Source: IMF

Following a remarkable recovery in the second and third quarters of 2021, the euro zone’s growth was expected to slow in the fourth quarter. The strong comeback of COVID-19, a prolonged drag on production from supply constraints in economies largely reliant on global supply chains, and dramatically rising energy costs were the causes that reversed this trend.

After reaching a 5.2% growth in 2021, the euro area growth is projected to wane to 3.2% in 2022 as a result of the higher inflation derived from the COVID-19 pandemic consequences and the Russian-Ukraine war. After 2023 it is expected that the euro area’s output stays between 1.5 and 1.8%.

Inflation was less than 1% at the start of 2021 and rose to 2.5% by the end of the year, owing to increasing energy costs and supply-side limitations. Inflation is predicted to remain high for the foreseeable future, recording 8.3% in 2022 and 5.7% in 2023. Energy costs, international and local demand-supply imbalances, the depreciation of the euro, substantial wage growth, and the above-mentioned Russian-Ukraine war will all contribute to pricing pressures.

In these conditions, inflation is only predicted to return to the European Central Bank’s (ECB) medium-term objective of 2% in 2026. To achieve this goal, the ECB is progressively raising interest rates to levels never seen since 2008 in order to reduce consumption and, as a result, inflation. Furthermore, until the end of February 2023, the ECB expects to reinvest in full the principal payments from maturing assets bought under the APP (Asset Purchase Programmes, the Quantitative Easing approach), which is the purchase of long-term securities on the open market.

In terms of unemployment in the eurozone, it is likely to follow the historical pattern of reducing over time. According to the IMF, the unemployment rate in 2021 was 7.7 percent and is predicted to fall to 6.7 percent by 2027.

4.2. United States

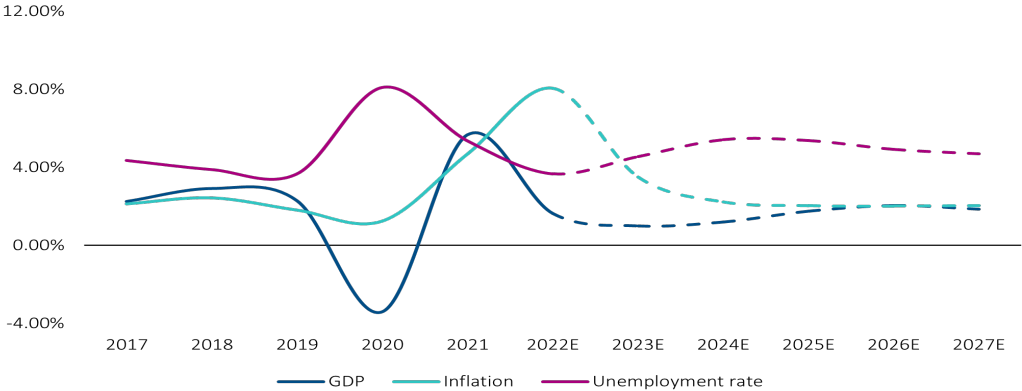


FIGURE 2. United States Macroeconomic Outlook, Source: IMF

In the United States, activity expanded at a slower-than-expected rate in the second half of 2021, with significant slowdowns in private consumption and factory output. Several unexpected headwinds, including COVID-19 breakouts, escalating supply shortages, and rising energy prices, as well as a fading boost to revenue from pandemic-related government support, hampered activity. Nonetheless, the US GDP rose 5.7% in 2021, the fastest yearly rate since 1984.

According to the IMF, the US economy is projected to decelerate in the next years. Along with global issues like the Russian-Ukraine war and supply-demand mismatches, the key drivers for the predicted GDP levels were greater inflation and the speedier withdrawal of monetary policy assistance than previously anticipated.

Meanwhile, inflation surprised the upside and widened across components, and a tightening labor market pushed salaries higher, particularly in the second half of 2021. The consumer price index for all products climbed 7 percent from December 2020 to December 2021, the highest December-to-December percentage shift since 1981, as supply could not keep up with increasing demand.

Given the current international and domestic conditions, the IMF projects an 8.1 percent rise in the US consumer price index in 2022.

To combat inflation, the Federal Reserve (FED) chose to halt its quantitative easing program and gradually raise interest rates. The Fed has lifted its short-term target federal funds rate from 0% to a range of 4.25 to 4.5% since March 2022.

The labor market was strong in 2021 and is predicted to remain so through the end of 2022. It created 562,000 new employment every month on average, with 6.7 million new jobs expected to be produced by 2021. After 2022, the unemployment rate is predicted to progressively rise until 2025, then gradually decline until 2027, hitting 4.7 percent.

4.3. China

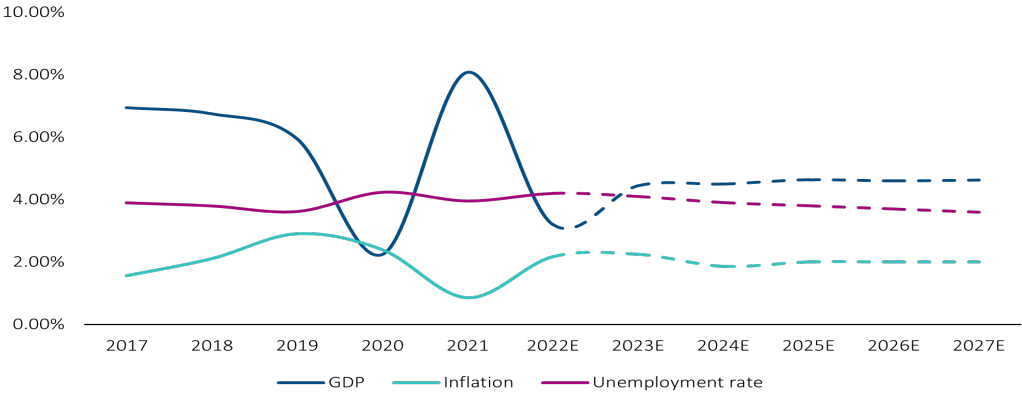


FIGURE 3. China Macroeconomic Outlook, Source: IMF

China’s 2021 economic forecast was highlighted by periodic mobility limitations due to the epidemic, as well as regulatory controls on the property and banking sectors, which hampered consumer spending and residential investment. In contrast, despite supply problems and electrical shortages, manufacturing activity has been mostly steady, and export growth has surged. Overall, China’s economy recovered in 2021, with the greatest growth in a decade.

The economy grew at its slowest rate in 44 years in 2020, but recovered faster than other major economies, growing at an annual rate of 8.1%. Following a strong rebound in 2021, the economy is expected to slow in 2022, recording an output growth of 3.2%. This slowdown reflects less favorable base effects, reduced export support, increased covid-19 pandemic outbreaks, and the government’s ongoing deleveraging efforts.

Consumer index prices increased 2.4% in 2020 and are expected to fall 0.9% in 2021. Over the forecasted period, China’s headline inflation is expected to rise due to base effects and increasing electricity and commodities costs. Aside from this acceleration, China’s consumer index prices are expected to remain stable at roughly 2% between 2023 and 2027.

Macroeconomic policy actions have helped to avert a more severe economic recession and have alleviated financial stress. The People’s Bank of China has offered short-term liquidity injections and reduced reserve requirements, while the government has increased infrastructure spending and measures to assist homeowners and creditworthy developers.

Aside from all these expectations, China faces three major problems. First, there will be a shift from external to domestic demand, as well as from investment and industry-led growth to a greater reliance on consumption and services. Second, there will be a shift from the significant weight placed on state leadership and regulation to a greater role for markets and the private sector, and third, there will be a shift from a high to a low-carbon economy.

CHAPTER 5

Industry Outlook

5.1. Historical Performance

The automotive industry is a crucial part of the global economy, producing vehicles that efficiently transport people and goods within nations and across entire regions. This industry includes all those companies and activities involved in the manufacture of motor vehicles, including most components, such as engines and bodies, but excluding tires, batteries, and fuel. The industry's principal products are passenger automobiles and light trucks, including pickups, vans, and sport utility vehicles. Commercial vehicles (i.e., delivery of trucks and large transport trucks, often called semis), though important to the industry, are secondary.

The automobile sector is often recognized as a highly cyclical industry; that is, it is very vulnerable to the business cycle, meaning that revenues are higher in economic expansions and lower in economic contractions. As a result, companies in this industry must be aware of such external influences and change their activities in accordance with the state of the economy.

According to the International Organization of Motor Vehicle Manufacturers (OICA), the global production of new vehicles has been decreasing since 2017 as shown in figure 4. The shock suffered in 2020 and 2021 has two main reasons: the covid-19 pandemic and the semiconductor shortage.

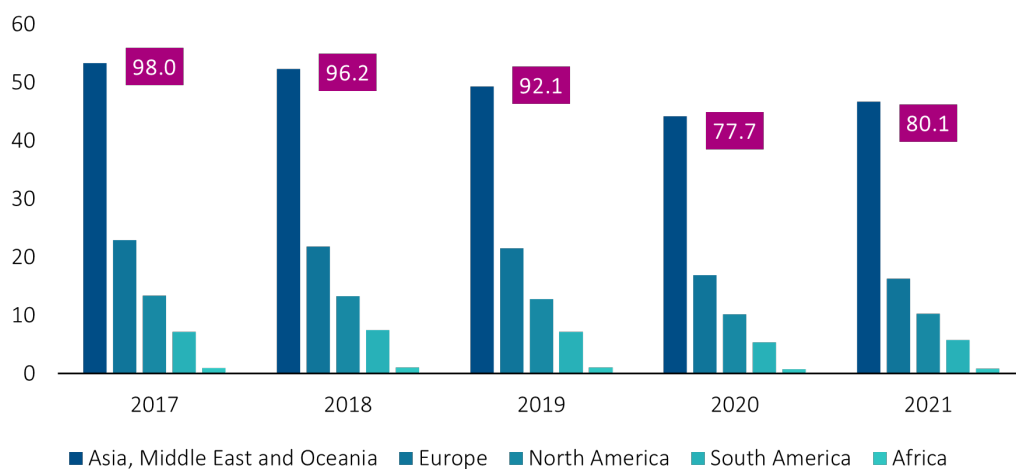


FIGURE 4. Global Vehicles Production by region 2017-2021 in millions, Source: OICA

Firstly, there was an overall decline in global economic activity that was driven by the sanitary measures imposed to struggle the pandemic. The semiconductor shortage is an ongoing global crisis in which the demand for integrated circuits (the “semiconductor chips”) exceeds the supply, affecting numerous industries. The crisis started in 2020 and was driven by the combined result of the effects of and the mitigation of the Covid-19 pandemic and the increase in global demand for PCs owing to some countries’ shift to a stay-at-home economy. The crisis has caused significant price rises, shortages, and consumer scalping for vehicles, graphics cards, video game consoles, computers, home appliances, and other devices requiring semiconductors.

Vehicle global sales show a similar pattern: a gradual decrease between 2017 and 2019, a significant reduction in 2020 and a slight increase in 2021. In 2021, there were sold over 82 million vehicles as shown in figure 5.

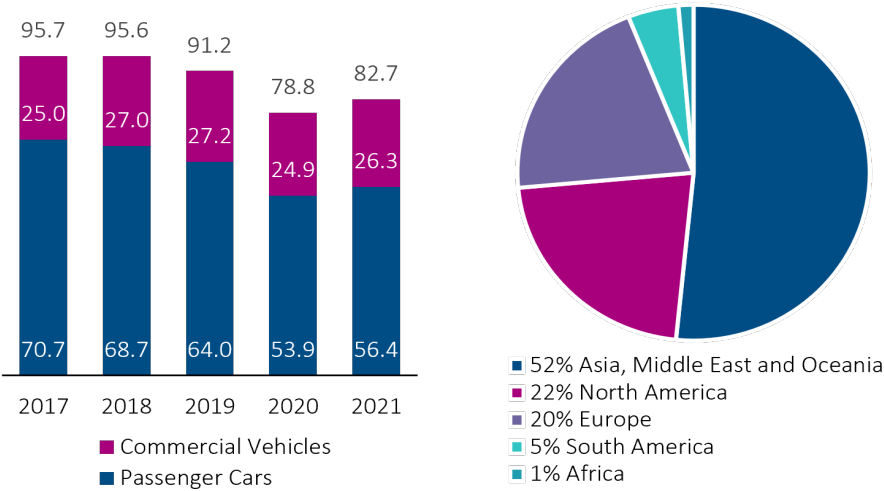


FIGURE 5. Global Vehicles Sales 2017-2021 in million and 2021 geographical vehicles sales in %, Source: OICA

As can be seen in the graphs above, Asia, the Middle East and Oceania have the higher production and sales of vehicles in the world, with more than 50% of the production and sales.

Additionally, it is important to analyze the past performance of Electric Vehicles, the most important trend in the industry. The worldwide electric vehicle market share has increased dramatically over the last decade, and it is expected this trend to continue.

According to International Energy Agency (IEA), sales of electric vehicles doubled in 2021 from the previous year to a new record of 6.6 million, comprising nearly 10% of global car sales, four times higher than the market share in 2019. In 2012, just 120 000 electric cars were sold worldwide; by 2021, more than that number would be sold each week. The graph below shows the evolution of the electric vehicle market.

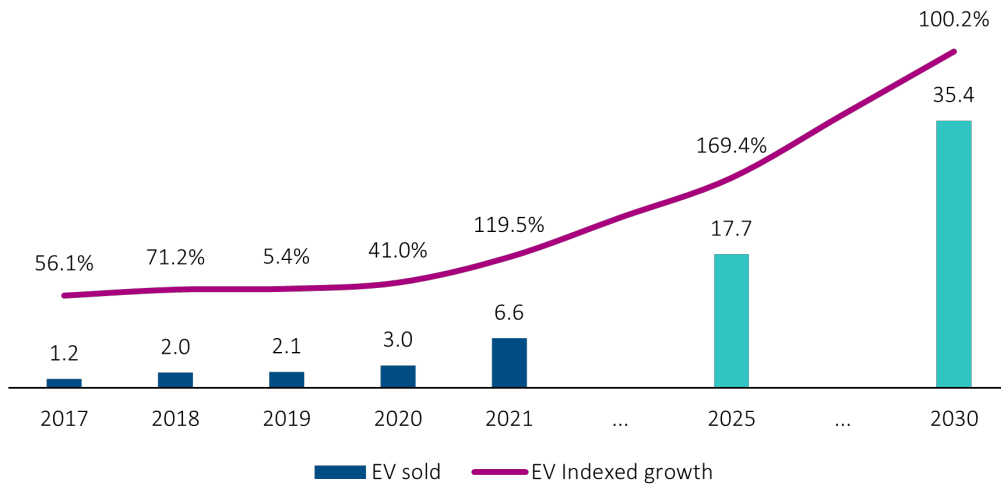


FIGURE 6. Electric Vehicles historical sales 2017-2021 and forecast in million, Source: IEA

5.2. Key Drivers

While short-term cyclicalities are vital to monitor, disruptive trends are what has been defining the industry over the decades. Many global changes are happening right now, shaping the automotive industry. Digitalization is shifting original equipment manufacturers' business models to providers of mobility services, creating new business models and opportunities: autonomous driving, connectivity, diverse mobility, and electrification.

5.2.1. Globalization

Globalization is a concept used in economics to define interconnected economies defined by free commerce, open capital flows among countries, and easy access to foreign resources, especially labor markets, in order to optimize returns and benefit the common good. The convergence of cultural and economic systems drives it; the more nations and regions become politically, culturally, and economically integrated, the more globalized the globe becomes.

The consequences of globalization benefit all businesses, and the automobile industry is not an exception. McDonald's is one of the most prominent examples of globalization: According to a Securities and Exchange Commission filing at the end of 2020, McDonald's had 39,198 fast-food establishments in 119 nations and territories.

On one hand, companies have taken advantage of all the benefits of globalization and established worldwide supply chains by outsourcing the production of car components, manufacturing, and other operations to more cost-effective countries. Globalization has had little effect on brand imaging since automotive brands tend to build on their roots and reputation.

On the other hand, because profit potential in mature countries was explored owing to the market's limited upside availability and severe competition, companies have penetrated these new regions to regain profitability.

5.2.2. Sustainability

Global warming is playing an essential role in our lives and is gaining increasing attention since, at a certain point, the harm produced by human pollution is irreversible, thus action must be taken promptly. To fight this situation, countries are enforcing stronger regulations on greenhouse gas emissions, one of which is through vehicle emissions.

Indeed, several countries have set out to achieve net-zero emissions by 2050 and some countries have even committed to phasing out all new sales of combustion engine vehicles over the next few decades. Therefore, as stated above, this should be one of the most important trends in the industry.

As a result, automakers are under pressure to switch to greener, more efficient energy sources. Hybrid vehicles were the first step toward the transformation of the industry. They have been on the market for a decade and successfully cut greenhouse gas emissions; nonetheless, they are insufficient in the long run. As a result, fully electric cars have the most potential.

These cars utilize batteries that are charged by energy, and they have a substantially lower carbon impact regardless of where the electricity is supplied. Obviously, it would be preferable to utilize exclusively clean renewable energy to power automobiles, but for that to happen, other businesses must also keep up the pace in order to lessen the carbon footprint.

Along with battery-powered electric vehicles, fuel cell electric vehicles (FCEV) are another alternative to internal combustion engines. FCEVs do not rely on a battery. Instead, they get power from a fuel-cell stack that's fed hydrogen and oxygen to create electricity through a chemical reaction. It's like a battery that can be refueled instead of recharged.

Although these types of cars are not yet penetrating the market like battery-powered EVs, the market for FCEVs is expected to grow at a remarkable CAGR, of nearly 70%, through 2026.

As shown above, this new market has been growing over the years and is expected to continue the high levels of investment in research and development. The massive rotation in the global vehicle fleet is predicted to take place in the 2030s.

5.2.3. Connectivity

Apart from electrification, connectivity through technology is another factor contributing to the race to build the cars of the future. In the previous decade, we have seen the development of various connection elements in the car sector, ranging from digital screens to external platforms such as Android Auto or Apple CarPlay. Nonetheless, the automobile industry is continuously seeking new methods to innovate. The automotive connection can only be considered imminent with the ongoing attempts to incorporate 5G, the Internet of Things (IoT), and Artificial Intelligence (AI).

Connectivity is divided into three categories: infotainment, telematics, and infrastructure. The relationship between the passengers and the vehicle is represented by infotainment, which includes in-car entertainment, an integrated digital cockpit, a heads-up display, and Wi-Fi. Telematics is the monitoring of information using telecommunication equipment such as the cloud. It can, for example, let the automobile collect data about the driver's behavior. The infrastructure connects the automobile to its environment, allowing it to identify and differentiate between traffic signals, people, and even other cars with the same function(s).

According to Exploding Topics, the worldwide connected car market is likely to be valued at around 88.4 billion dollars in 2023 and is expected to increase to 191.8 billion dollars by 2028. The deployment of 5G technology will fuel the expansion.

5.2.4. Shared Mobility

According to the United Nations, cities already house 55% of the world's population, with that figure expected to rise to 68% by 2050, increasing the difficulty of having a car owing to traffic congestion, a shortage of parking spaces, maintenance and fuel costs, and so on. This is also a current concern because people's mobility patterns are changing. As a result, a multitude of distinctive on-demand transportation choices will arise, mostly in highly populated areas where privately owned autos are actively discouraged.

In the short term, one of the most important features of the automotive sector is the potential to tackle these issues with ride-sharing solutions, which have the incentives to grow since they are a low-cost choice that reduces road congestion and is environmentally friendly.

As car-sharing grows more widespread, total automotive sales, particularly of private automobiles, may shrink. However, this will be offset in large part by a larger need to replace shared automobiles, since they will be used more frequently and hence depreciate faster due to wear and tear. Furthermore, global automotive sales are likely to expand further in the future, driven mostly by emerging nations such as China and India, with established markets falling.

5.2.5. Autonomous Mobility

If, Electric Vehicles are considered the most important trend in the industry, Autonomous Vehicles can be perceived as the most disruptive one.

According to a recent study made by Deloitte, "in recent years, autonomous driving and so-called robotaxis have become one of the hottest topics in the automotive industry - and beyond!".

An autonomous vehicle is made up of a variety of networking technologies and sensors that let the computer drive the vehicle. Significant technological improvements, including sensor processing, adaptive algorithms, high-processing maps, and better AI, have helped enterprises to expand production capacity and propel the autonomous vehicle industry forward.

Government funding, the supportive legislative environment, and investments in digital infrastructure are all expected to boost demand for self-driving vehicles. Furthermore, they offer autonomous movement for those with disabilities, and they provide a great level of flexibility and comfort for travelers to relax, read, or even work while flying, which increases their efficiency.

Aside from the benefits, the expensive cost of autonomous cars, growing concerns for security and safety, and a lack of sufficient infrastructure to support automated vehicles in underdeveloped nations limit market expansion. Government actions to boost electric and hybrid cars, on the other hand, are projected to push the market for autonomous vehicles in the coming years.

Recent autonomous car projections predict that more than 30 million autonomous vehicles will be sold by 2040.

5.3. Automotive Industry: where to?

Overall, the automotive industry is heading towards a brighter and cleaner future. OEMs are extensively working on their R&D to create cars tailored to the customers' needs and suitable for the environment. While electrification will play a big role in reducing GHG emissions, connectivity will provide customers with interactivity and more comfort and autonomous mobility will boost consumers' efficiency.

Therefore, there will certainly be a massive need for expert skillsets to develop these vehicles for the future and the competition and further partnerships across industries will also begin.

As a result, the time is coming when the automobile industry must consider whether its current simple business model of merely building and selling cars is sufficient.

CHAPTER 6

Volkswagen AG

The Volkswagen AG, or Volkswagen Group, was created by the German Labour Force in 1937 and is now one of the world's largest corporations. It gets its name from the German words Volk and Wagen, which mean "people's automobile" when combined.

Alongside 662,575 employees worldwide and 120 manufacturing plants distributed by 19 European nations and another 10 in the Americas, Asia, and Africa, the group sells its vehicles in 153 countries.

The Group comprises ten brands from five European countries: Volkswagen, Volkswagen Commercial Vehicles, ŠKODA, SEAT, CUPRA, Audi, Lamborghini, Bentley, Porsche and Ducati. Additionally, the Volkswagen Group provides a diverse range of further brands and business units including financial services.

6.1. Volkswagen Foundation

In the early 1930s, Germany's car industry mostly comprised luxury cars and, in those days, not everyone could afford a car. Having this problem in mind, Adolf Hitler intervened in 1934, ordering the development of a basic vehicle capable of carrying two adults and three children at 100 km/h, an automobile that every German family would be able to afford.

However, it soon became clear that private industry could not produce a car with those characteristics. As a result, Hitler chose to fund an all-new, state-owned factory using Ferdinand Porsche's design with some modifications with the intention that German households could buy the car through a savings scheme – "Five marks a week you must set aside if, in your own car, you wish to ride".

On May 28th, 1937, the German Labour Force ("Deutsche Arbeitsfront") formed the Gesellschaft zur Vorbereitung des Deutschen Volkswagens mbH and, more than a year later, it was renamed Volkswagenwerk GmbH. The automobile body of the prototype, which was recognizably the Beetle recognized today, was designed by Erwin Komenda, the veteran Auto Union chief designer, as part of Ferdinand Porsche's hand-picked team.

Before the Second World War began in 1939, just a few automobiles had been constructed. Ivan Hirst, a British major, gained leadership of the bomb-ravaged facility after the war. Hirst planned to deconstruct the plant and move it to the United Kingdom. Because the facility lacked the core mechanical criteria of a motor car, no British automobile manufacturer was interested in it. The firm survived by manufacturing vehicles for the British army and, in 1949, Hirst left the company.

Volkswagen’s globalization beyond Europe was initially displayed in the United States in 1949 and rapidly spread across the world.

Nowadays, the Volkswagen Group is one of the best automobile manufacturers in the world.

6.2. Ownership Structure

As of 31st December 2021, Porsche Automobil Holding SE was the major shareholder of the group, holding 31.4 percent of Volkswagen AG. The free-float part of the shareholder structure was 30.3 percent of the total equity. Additionally, 11.8 percent of the group was state-owned by the State of Lower Saxony, Germany. Finally, 16.6 percent were detained by private shareholders.

The primary exchange of the group shares is in Frankfurt and at that date, there were outstanding 206 million preferred shares² and 295 million ordinary shares.

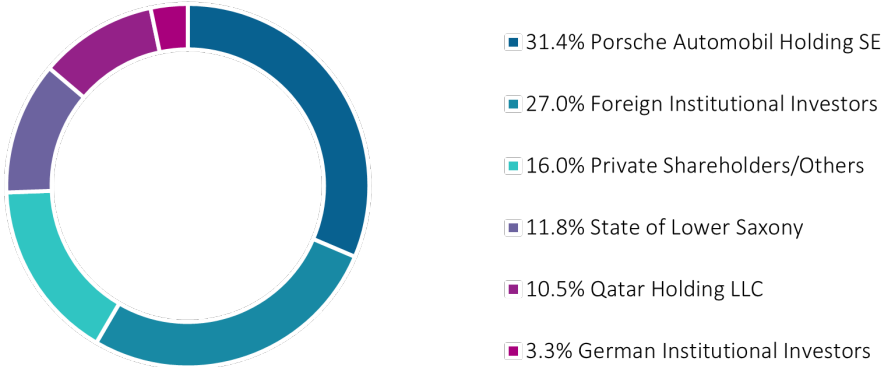


FIGURE 7. Shareholder Structure, Source: VW Annual Report 2021

6.3. Volkswagen Group

Volkswagen is an automobile manufacturer company and is the mother company of the Volkswagen Group. The group is one of the biggest automobile groups in the world that comprises Volkswagen, other well-known car brands and other brands and business units.

In the following list, is possible to see the automobile manufacturer companies that comprise the group Volkswagen and its respective acquisition year:

(1937) Volkswagen

(1965) Audi: a German luxury car manufacturer that was founded in 1931.

(1990) Seat: a Spanish manufacturer founded in 1950.

(1991) Skoda: a Czech automobile manufacturer that was founded in 1885.

(1995) Cupra: Cupra was formed in 1995 as a subsidiary of SEAT, but it later became its own brand, creating its own models independent of SEAT.

(1995) Volkswagen Commercial Vehicles: founded in 1995 in Hanover, Germany.

(1998) Lamborghini: In 1963, Ferruccio Lamborghini created the Italian firm. By 1987, it had changed hands several times before being purchased by Chrysler and then, Volkswagen acquired the firm.

(2003) Bentley: a luxury automobile manufacturer founded in 1919.

(2012) Ducati: an Italian motorcycle manufacturer headquartered in Bologna founded in 1926. Volkswagen purchased Ducati through its Audi subsidiary.

(2015) Porsche: The German car manufacturer was founded in 1931. In August 2009, the two companies' management decided to merge the two entities. By the end of 2015, Volkswagen held a majority shareholding in Porsche.

Additionally, the group offers a wide range of further brands and business units including financial services, such as:

- **Volkswagen Financial Services (1948):** is the Volkswagen Group's financial and mobility services provider. The primary business sectors include dealer and customer finance, leasing, banking and insurance, fleet business, and other mobility services.
- **Traton SE (2015):** with a portfolio comprising Scania, MAN, Volkswagen Truck Bus, Navistar, and RIO brands, Traton SE is one of the world's top commercial vehicle manufacturers. Light commercial vehicles, trucks, and buses are all part of the offering.
- **MOIA (2016):** is the Volkswagen Group's youth mobility firm that creates on-demand ride-sharing services to revolutionize urban transportation. To this purpose, MOIA works in conjunction with cities and public transit operators.
- **Volkswagen Group Components (2019):** a realignment of the Group-wide components business was decided on as part of the enhanced new Group Strategy 2030 and implemented as of January 1, 2019. The goal is to increase future viability and competitiveness through cross-brand management of component operations and a value-generation strategy integrated throughout the Group. Synergies will be used across both old technologies and future subjects to accelerate the gradual transition to e-mobility.
- **Cariad (2020):** is a software firm and the top automotive technology platform. Its objective is to consolidate and grow the Volkswagen Group's software skills. Its purpose is to make driving safer, more sustainable, and more comfortable for individuals. CARIAD's focus on software-defined vehicles contributes significantly to the Group's NEW AUTO strategy's success.
- **Volkswagen Group Fleet International:** Wholesale business in the Volkswagen Group is coordinated for all countries and brands by Volkswagen Group Fleet International. This comprises all national and international brands engaged in this segment: Volkswagen Passenger Cars, Audi, SEAT, KODIAK, and Volkswagen Commercial Vehicles.

6.4. Volkswagen Business Segments

Volkswagen Group manufactures and sells passenger automobiles and commercial vehicles. Additionally, the company also produces vehicles and components for the other brands in the group. Volkswagen operates in two different divisions: the Automotive Division and the Financial Services Division.

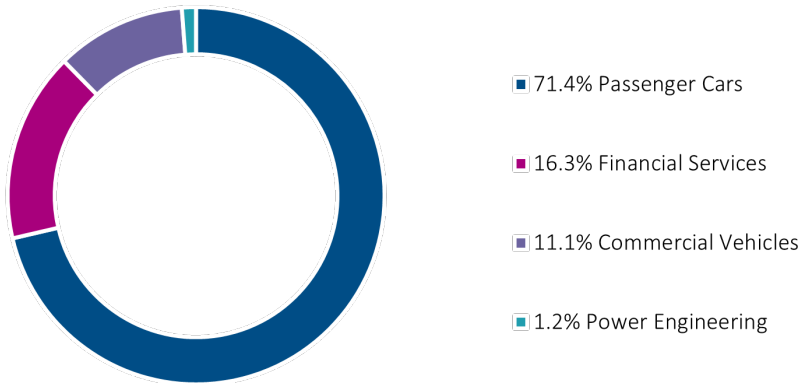


FIGURE 8. 2021 Sales revenue by segment in %, Source: VW Annual Report 2021

The Automotive Division comprises Passenger Cars, Commercial Vehicles and Power Engineering. The Passenger Cars section includes the development of vehicles and engines, the manufacture and sale of passenger cars and light commercial vehicles and the corresponding genuine parts business. The Commercial Vehicles section comprises the design, manufacture, and sale of light commercial vehicles, trucks, and buses, as well as the related authentic parts business and related services. The Power Engineering section develops and manufactures large-bore diesel engines, turbo compressors, industrial turbines, and chemical reactor systems, as well as gear units, propulsion components, and testing systems.

Additionally, the Volkswagen Group provides a broad variety of financial services, such as dealership and customer financing, leasing, banking and insurance activities, fleet management, and mobility services.

6.5. NEW AUTO Strategy

In July of 2021, Volkswagen Group unveiled the NEW AUTO strategy until 2030 – a new transformation plan to become a “software-driven mobility group”.

NEW AUTO thus continues the transformation begun by the former strategies, TOGETHER 2025 and TOGETHER 2025*, which launched one of the most significant shift processes in the company’s history with the goal of “making the group more focused, efficient, innovative, customer-oriented, and sustainable, and systematically gearing it toward profitable growth”.

The strategy was inspired by the necessities of the automotive industry. As stated above, beyond the transformation toward e-mobility and digitalization, the most crucial

milestone is the development of autonomous driving, which will permanently redefine customers’ experiences of mobility and create the way for new business models.

In order to meet these needs, it was elaborated a total of twelve group initiatives across the brand groups form the NEW AUTO, as can be seen in the following figure:

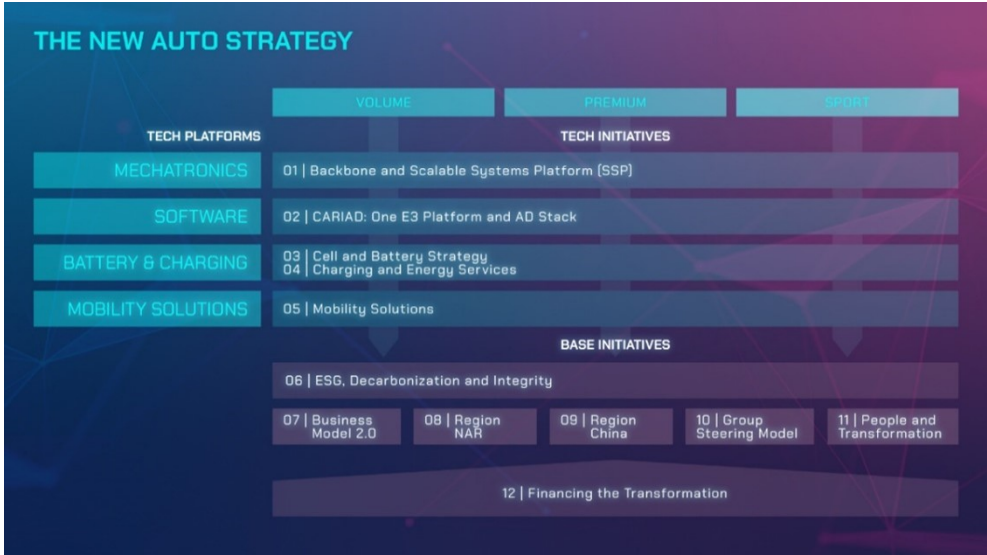


FIGURE 9. NEW AUTO Strategy, Source: VW Annual Report 2021

NEW AUTO’s primary transdisciplinary areas include mechatronics, software, battery & charging, and mobility solutions. Each of these topics has associated with a key technology platform that will serve as the base for this transformation.

In terms of mechatronics, the group is transitioning to the Scalable System Platform (SSP), a next-generation all-electric mechatronics platform that will provide a uniform architecture for the whole product portfolio beginning in 2026. This project will allow for maximum synergy effects, lower investment costs, and rapid, frequent technological updates, all while ensuring the group’s required product distinction.

The software strategic goal is to develop a single global software platform for all cars in the group. The transformation will be led by CARIAD, an automotive software company held by Volkswagen Group, and is expected to occur in 2025 – “in 2025, CARIAD plans to launch a new unified, scalable software platform and end-to-end electronic architecture”.

In terms of batteries, the company is seeking vertical integration. Volkswagen’s objective is to create a single battery cell type, which is expected to reduce costs by 50 percent. The Volkswagen Group plans to provide clients with a one-stop shop for everything from charging hardware to Energy Management Services.

The final element of the strategy is a comprehensive package of mobility solutions. Volkswagen Group intends to develop autonomous driving with its strategic partners ARGO AI and MOIA.

To achieve progress in the relevant projects, the group board of management resolved to structure and routinely measure the strategic goals and milestones using the OKR (objectives and key results) technique.

6.6. Risks and Opportunities

A SWOT analysis is a strategic plan that evaluates a company’s strengths, weaknesses, opportunities, and threats. As a result, it may enable companies in finding areas for improvement and unexplored opportunities, as well as detecting negative components that may inhibit their success.

Strengths and weaknesses are internal factors of a company that provides a relative advantage, or disadvantage, over its competitors. Volkswagen AG is one of the best-positioned companies in the market due to its strengths such as the significant RD investment made over the years, the broad portfolio and resulting synergies, and the robust worldwide manufacturing network. On the other hand, ineffective marketing strategies outside of Europe, as well as the fact that unions control half of the votes on Volkswagen’s 20-member supervisory board, are slowing the company’s development.

Opportunities and threats, on the other hand, are components of the external environment that management may use to improve corporate performance. Companies in the automotive sector can and should invest in emerging markets, electric vehicles, and autonomous driving if they want to grow their worldwide market share. Additionally, companies in this business may be forced to retrench as a result of rising competition and a lack of semiconductors.

The following graph shows Volkswagen AG’s SWOT. Although the automobile business is defined by intense competition and ongoing innovation, it is expected that the firm will be able to retain or even increase its market share in the future assuming it maintains current investment levels and its strategy is carried out as planned.

<p>Strengths</p> <ul style="list-style-type: none"> Brand recognition Portfolio with impressive brands NEW AUTO strategy Huge investment in R&D Manufacturing Capacity Current market share 	<p>Weaknesses</p> <ul style="list-style-type: none"> 2015 Dieselgate Scandal Lack of Diversification Weak marketing strategies outside Europe Management Structure
<p>Opportunities</p> <ul style="list-style-type: none"> Electric Vehicles Emerging Markets Autonomous Driving Automotive Battery Supply 	<p>Threats</p> <ul style="list-style-type: none"> Increasing Competition Stringent Environmental Regulations Semiconductor Shortage Global Economic Outlook

FIGURE 10. SWOT Analysis, Source: Own research

6.7. Shares and Bonds

6.7.1. Shares

As stated above, Volkswagen Group comprises two types of public shares: preferred shares and ordinary shares. Both are traded in Frankfurt Stock Exchange and they are included

in major stock indices such as DAX, Prime All Share, EURO STOXX Automobile & Parts and S&P Global 100 Index, among others.

Following the next graphs, is possible to comprehend how Volkswagen’s ordinary and preferred stock prices have performed in the last 10 years. The first graph presents the weekly stock prices over the last 10 years of Volkswagen Ordinary Shares (VOWG.DE), Volkswagen Preferred Shares (VOWG_p.DE), and the Deutsche Boerse AG (GDAXI). The second graph shows the relative performance of these instruments and also the relative performance of the EURO STOXX Automobile & Parts (SXAE).

The GDAX comprises an index of 40 selected German chip stocks traded on the Frankfurt Stock Exchange, whereas the SXAE is a European index that tracks the biggest companies within the Automobiles Parts super sector.

As can be seen from exhibit 11 the stock price has followed DAX over the past 10 years, except for two periods: in September 2015 and in the beginning of 2021.

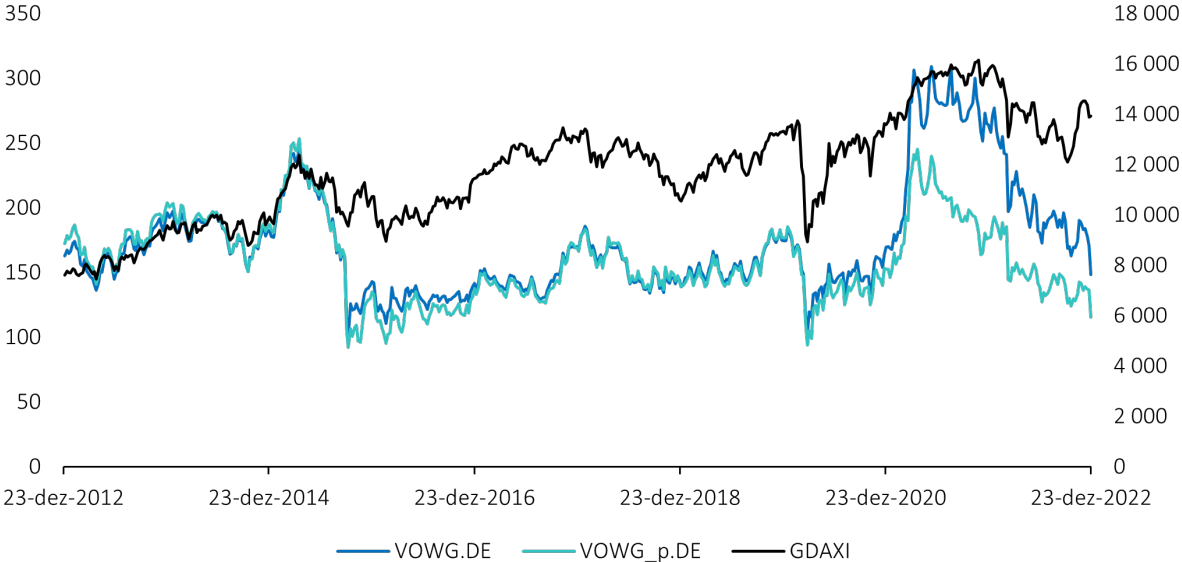


FIGURE 11. Historical VW Stock Prices and DAX Index Prices, Source: Thomson Reuters

September 2015 was marked by Volkswagen’s Emissions Scandal, or Dieselgate, when the US Environmental Protection Agency (EPA) found that in over 590,000 diesel motor vehicles, Volkswagen had violated the Clean Air Act as the vehicles were equipped with “defeat devices” in the form of computer software, which was designed to cheat on federal emissions tests. This event had a negative impact on Volkswagen’s Stock Price, which shrink around 40 percent in September.

On the opposite, at the beginning of 2021, outperformed the stock market due to the expected good business performance in 2021 and the announced strategy for the coming years, the NEW AUTO, which comprises the acceleration of the expansion of e-mobility and the associated battery technology.

From the following graph, it is possible to comprehend that the expected outlook for 2022 had a significant negative impact on Volkswagen’s Stock Price. The war in Europe and the limited supply of semiconductors bring up inflation to levels’ never bitten before. High levels of inflation affect global demand which will subsequently affect sales and business growth.

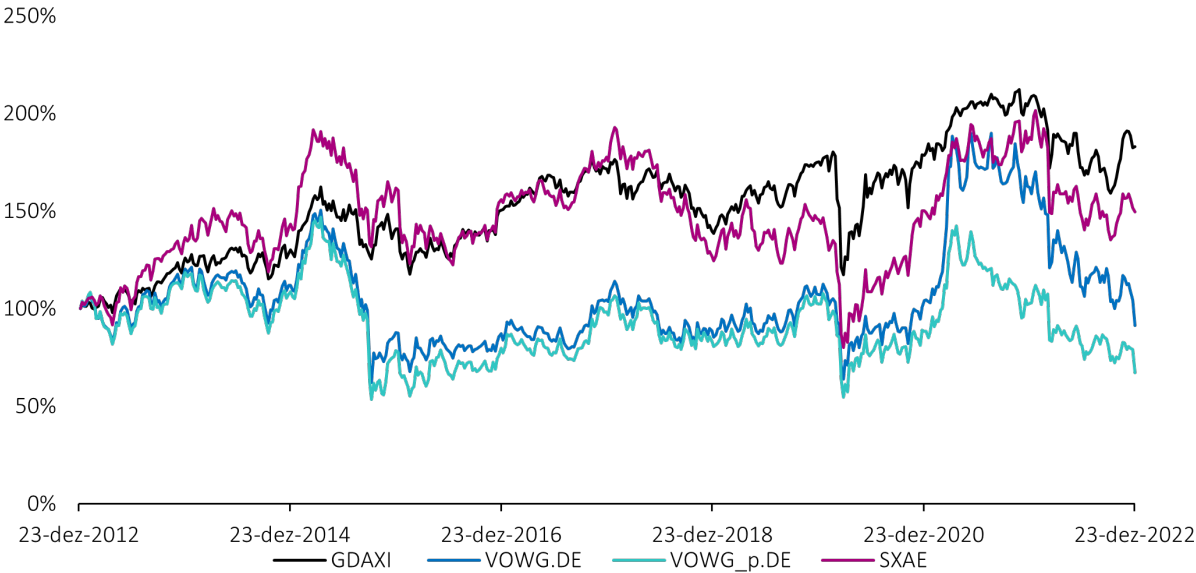


FIGURE 12. Indexed Performance of VW, DAX and SXAE, Source: Thomson Reuters

6.7.2. Bonds

In 2022, both rating agencies, Standard Poor’s and Moody’s Investors Services, classified the outlook of Volkswagen AG as “stable”, maintaining the ratings given in the past year. For long-term debt, the agencies are classified as BBB+ and A3, and for short-term debt, A-2 and P-2, respectively. There was a slight upgrade in 2021 compared to 2020 due to a stronger-than-expected free cash flow generation of the firm and the expected improvement in Volkswagen’s credit metrics.

6.8. ESG

Today, environmental, social and governance (ESG) issues are at the heart of corporate activity. Thanks to ESG criteria, it is possible to assess the responsibility of companies towards the environment and their stakeholders (employees, partners, subcontractors, and customers).

Accordingly to Reuters, in 2021 Volkswagen AG had an average ESG score of 85.14, fluctuating from a high of 88.81 in 2020 to a low of 81.59 in 2018, over the last 5 years. The Environmental pillar fared the best of the three pillars that comprise the overall ESG score, with a 5-year average score of 92.75, followed by the Social pillar (Average score: 92.64) and lastly the Governance pillar (Average score: 61.70).

Over the past 5 years, Community, Resource Use, and Workforce are the three best-scoring categories while Shareholders, Management, and CSR Strategy are the three underperforming categories.

	<u>2017</u>	<u>2018</u>	<u>2019</u>	<u>2020</u>	<u>2021</u>
ESG Combined Score	C	C	C+	C+	C+
ESG Score	A-	A-	A+	A+	A+
Environmental Pillar Score	A-	A-	A+	A+	A+
Social Pillar Score	A-	A-	A+	A+	A+
Governance Pillar Score	B-	B-	B	B+	B
ESG Controversies	D-	D-	D-	D-	D-

FIGURE 13. ESG Performance, Source: Thomson Reuters

In comparison with Volkswagen’s closest four peers by industry and market capitalization in 2021, the company surpasses Toyota in terms of ESG Combined Score and surpasses Toyota and BYD Company in terms of ESG Score.

	<u>Volkswagens</u>	<u>Toyota Motor</u>		<u>Mercedes</u>	
	<u>AG</u>	<u>Corp</u>	<u>BYD Co Ltd</u>	<u>Benz AG</u>	<u>BMW AG</u>
ESG Combined Score	46.2	45.4	51.2	55.4	61.0
ESG Score	86.6	82.8	51.2	93.4	89.5
Environmental Pillar Score	94.5	90.8	71.1	96.5	81.4
Social Pillar Score	93.1	81.5	30.9	89.8	94.1
Governance Pillar Score	64.2	73.5	58.0	95.2	93.1
ESG Controversies	5.8	8.1	100.0	17.4	32.6

FIGURE 14. ESG Performance, Source: Thomson Reuters

CHAPTER 7

Three-Statement Model

In this chapter it will be presented the assumptions and approaches to calculate and modulate Volkswagen's Financial Statements. The financial statements will be estimated until the end of the period covered by the intrinsic valuation, 2027.

Forecasting the income statement is crucial when creating a three-statement model since it produces most of the inputs for the projections of the rubrics in the balance sheet and cash flow statement. While the income statement rubrics are projected, most of the balance sheet items are also estimated, in the sense that the cash flow statement and, ultimately, the debt and cash levels are calculated.

Some of these rubrics were forecast based on last year's absolute or relative to other rubric values, or on a simple or moving average of prior years' performance as a percentage of previous years' other rubrics. It is crucial to note, however, that some rubrics have assumptions that are not so obvious and so, they are going to be analyzed in this chapter.

7.1. Income Statement Figures

7.1.1. Sales Revenue

In most three-statement models, the sales revenue projection is arguably the most crucial forecast. Most of the subsequent lines in the income statement and most of the balance sheet accounts movements will be predicated based on the sales revenue figure.

Sales revenue may be projected in a variety of ways. Sales can be modeled as a basic annual growth rate, a component of a macroeconomic indicator, or the result of a regression model, among other possibilities.

Volkswagen's sales revenue will be based on the output of regression models, based on yearly and quarterly reports published through the third quarter of 2022 and some macroeconomic indicators gathered from the International Monetary Fund (IMF). The use of these interim reports for 2022 will provide more accuracy in estimating sales revenue for the year 2022.

Given the company's sales revenue divided by segment or by geography, it is assumed that estimating the sales revenue by geography will be more accurate than estimating them given its segmentation.

After several attempts, the method developed to build regression models was based on the quarterly and absolute values of sales revenue. Therefore, for each geography, it will be created four different regressions. These regressions are based on the company's prior results and on some macroeconomic variables. The four previous quarters are the explanatory variables based on prior results, and the average oil price and the country's

(with the biggest market share in the geographic area) gross domestic product and average consumer price were the macroeconomic variables.

In order to assess the validity of the models, tests such as the global significance of the regression, the F-test, and a test to confirm the regression’s validity, the RESET test, were performed. The individual significance test, t-test, was used to adjust the model, and therefore non-statistically significant explanatory variables were excluded from the model. The graph below displays the final regressions as well as the results of the global test.

Please note that “Qi” stands for the quarter i (i = 1, 2, 3, 4), “GDP” for the gross domestic product at constant prices (or, inflation-adjusted), “INF” for inflation, “Oil avg” for the average change in the price of oil and “n-1” for last year. Additionally, “ger” stands for Germany, “usa” for the United States, “br” for Brazil and “chi” for China.

As shown in the graph, all the regressions are globally significant for a 5 percent confidence level and all of them have good explanatory power, with an Adjusted R-Squared higher than 0.75. The forecasted sales revenue can be consulted in Appendix A.

	Adj. R-Squared	F Test p-value
Europe & Other Markets		
Q1 = -256.15 + 0.78 Q4 n-1 + 57675.32 GDP ger + 0.20 Q2 n-1	0.946	7.86E-08
Q2 = 5174.38 - 0.90 Q4 n-1 + 1.77 Q1	0.802	2.38E-05
Q3 = 4268.49 + 1.03 Q1 - 3767.88 Oil avg + 59351.67 INF ger - 0.23 Q2	0.945	5.29E-07
Q4 = -61.26 + 1.10 Q3	0.953	1.54E-09
North America		
Q1 = -35.69 + 0.95 Q4 n-1	0.968	2.60E-11
Q2 = -568.24 + 0.70 Q4 n-1 + 102880.80 INF usa - 6060.27 Oil avg + 71907.47 GDP usa	0.925	2.47E-06
Q3 = -628.88 + 54796.45 INF usa - 2440.49 Oil avg + 0.70 Q1 + 0.32 Q2	0.978	5.10E-09
Q4 = 660.80 - 0.34 Q2 + 0.61 Q3 + 0.67 Q4 n-1 + 20621.60 GDP usa	0.986	5.54E-09
South America		
Q1 = 290.12 + 0.38 Q4 n-1 + 9337.02 GDP br + 0.40 Q3 n-1	0.771	2.07E-04
Q2 = 25.08 + 0.80 Q1 + 8320.92 GDP br + 105999.57 INF br	0.799	1.04E-04
Q3 = 427.68 + 0.93 Q2	0.804	3.66E-06
Q4 = 96.51 + 0.38 Q4 n-1 + 0.61 Q3	0.764	1.41E-04
Asia Pacific		
Q1 = -3775.53 + 0.50 Q4 n-1 + 42231.83 GDP chi + 0.54 Q2 n-1	0.930	3.29E-07
Q2 = 552.80 + 0.64 Q1 + 0.38 Q3 n-1	0.941	1.63E-08
Q3 = 4766.16 + 0.84 Q1 - 36956.85 GDP chi	0.910	2.12E-07
Q4 = 5134.07 + 0.49 Q3 - 45464.90 GDP chi + 0.40 Q2	0.958	9.94E-08

FIGURE 15. ESG Performance, Source: Thomson Reuters

7.1.2. Other considerations

Interest Expense Rate: The performance of the EURIBOR 6m and its forward curve were considered to determine interest income and costs. After determining the historic interest rate by dividing the interest rate income or expenses by its current levels of equity investments and financial debt balance, respectively, the spread between that rate and

EURIBOR 6m was calculated. After that, the spread of 2021 was taken into consideration and was added to the forward EURIBOR 6m rate. The historic EURIBOR 6m was taken from Thomson Reuters and the forecast was gathered from its forward curve available on Chatham Financials.

Corporate Income Taxes: A similar approach was used to predict corporate income tax. Given the aggregated tax rate in Germany and the effective tax rate, it was computed the spread between both rates. After this historical spread, 2021's spread was taken into consideration and added to the aggregate tax rate. The overall tax rate of 30 percent was assumed to stay constant during the predicted timeframe. Furthermore, it was considered that there would be no change in deferred taxes, tax receivables and payables, or tax provisions.

7.1.3. Balance Sheet Figures

Fixed Assets: Two major assumptions were established in order to forecast fixed assets. Fixed assets include intangible, tangible (property, plant, and equipment assets), lease, investment property assets, and equity-accounted and other equity investments. Firstly, every increase in the historical gross balance of each asset was considered an investment in that asset. This addition will grow as the historical average of investments as a percentage of sales throughout the projected horizon. The second assumption assumes that any increase in cumulative amortization, depreciation, and/or impairment was the annual cost of amortization, depreciation, or impairment. This expenditure will grow at a rate equal to the historical average of amortization, depreciation, or amortization expense as a percentage of the asset's gross value at the end of the preceding quarter.

Retained Earnings: Regarding retained earnings, every historical increase was assumed to be driven by the positive effect of net income and by the negative effect of last year's dividends (it was considered last year because even though these dividends are generated in the same period as the net income, they are only paid in the next year).

Additionally, dividends were assumed to grow at a determined payout ratio. The payout ratio was 24.45 percent in 2021 and it is expected, following the development plan of Volkswagen AG, that it reaches 30 percent in 2025. Therefore, continuous growth from 2021 until 2025 was assumed until the payout ratio reaches 30 percent. For 2026 and 2027 it was assumed the same payout ratio as in 2025.

Net Debt: In a nutshell, net debt items such as financial debt (borrowings) and cash and cash equivalents were anticipated to be the same as in 2021. This is because the revolving credit facility will adjust the quantities of borrowings and cash afterward.

7.1.4. Cash Flow Statement Figures

Revolving Credit Facility: Finally, projecting debt takes a completely different strategy than any of the other line items examined so far in this chapter. The revolving credit line ("revolver") is the result of the cash flow statement in most three-statement models

and functions as a plug to guarantee that debt is automatically pulled to cover predicted losses. When there is a forecasted excess, cash behaves similarly.

After having all the estimates for the income statement and the balance sheet, maintaining the levels of debt and cash constant, is possible to compute the cash flow statement. As an output, the levels of cash surplus or deficit are obtained for each period. In the years that were a cash surplus, the facility simply adds the surplus to the prior year's ending cash balance, through retained cash rubric, to arrive at the end-of-period cash on the balance sheet. On the other hand, a cash deficit will obligate the facility to use the revolver as a plug such that any cash losses lead to additional borrowing. This ensures keeping a financial model balanced because it calculates any excess cash generated or cash shortfall for a given year.

CHAPTER 8

Company Valuation

After the presentation of the external and internal outlooks of the company, it is time now to conduct the valuation.

In this chapter, it will be conducted the intrinsic and relative valuation of the company. The former will be estimated the share price of the company based on the Discounted Cash Flow through the FCFE and it will also be highlighted two other intrinsic valuation methodologies, such as the Discounted Cash Flow through the FCFE and the DDM. Additionally, it will be performed a sensitivity analysis to understand the potential impacts of a change in the beta or in the perpetual growth rate of the company. On the other hand, the relative valuation will be performed through the forward P/E, EV/EBITDA and EV/Sales multiples.

8.1. Intrinsic Valuation

8.1.1. Weighted Average Cost of Capital (WACC)

Cost of Equity, k_e

The cost of equity was computed based on the CAPM.

Firstly, to estimate a proxy for the risk-free rate, it was applied the 10-year German government bond. As recommended in the Literature Review, this rate is considered the best proxy to use due to its high liquidity and default-free characteristics. According to Thomson Reuters, the 10-year German Government Bond rate was 2.299 percent on December 20, 2022.

The equity risk premium illustrates the higher rate of return expected for investing in the country's stock market instead of investing in risk-free government bonds. The premium is an important factor when evaluating a company because it represents an essential gauge of the state of the market. The equity risk premium was gathered from the NYU Stern website.

Volkswagen ERP	20-21 Rev. Avg. Weight	ERP	Weighted ERP
Germany	18.47%	4.24%	0.78%
Europe/Other Markets	40.48%	5.07%	2.05%
North America	17.28%	4.24%	0.73%
South America	4.14%	8.20%	0.34%
Asia-Pacific	19.63%	5.28%	1.04%
			4.94%

FIGURE 16. Equity Risk Premium, Source: NYU Stern and own calculations

Given Volkswagen’s operational geography, to better access a good fit for the equity risk premium, a weighted average for the equity risk premium was applied. The weighted average was calculated based on the different geographies where the company operates and its current volume of generated sales. The demonstration of this approach can be seen in figure 16.

Finally, to address Volkswagen’s stock systematic risk, two linear regressions based on 5-year monthly returns were used. The Deutscher Aktien Index (DAX), a stock index that includes 40 of the biggest and most liquid German firms that trade on the Frankfurt Exchange, is the most appropriate benchmark for the company’s shares. Since Volkswagen has two different types of equity instruments, preferred and ordinary shares, a weighted average of both betas was taken into consideration. The 5-year monthly returns were taken from Thomson Reuters. The output of the linear regression comprises a raw Beta of 1.40 and the outputs of the regressions are in Appendix E.

Finally, after estimating all the necessary inputs for the CAPM, the cost of equity was computed:

Cost of Equity	
Risk-free rate in EUR	2.30%
Market Risk Premium	4.94%
Beta Levered	1.40
	9.22%

FIGURE 17. Cost of Equity, Source: Thomson Reuters and own calculations

After-tax Cost of Debt, $k_d(1 - t_c)$

Since Volkswagen has publicly traded debt, the better approach to estimate the company’s cost of debt is addressing the average yield to maturity of its outstanding debt.

According to Fitch Ratings, Volkswagen’s long-term default rating improved this year, from BBB+ to A-. This is a good signal for Volkswagen because it is seen as a lower-risk company and therefore, the demanded expected return on debt is lower.

According to Thomson Reuters, Volkswagen had almost 600 outstanding bonds. To shorten this list, only liquid, option-free and long-term debt should be considered. Therefore, a sort for bonds with a maturity equal to or higher than 5 years and a sort for bonds with quotes were applied. This resulted in 110 outstanding bonds.

Finally, the weighted average of the yields to maturity on these bonds was computed. As a result, the estimate for Volkswagen’s cost of debt is 4.31 percent (as shown in Appendix E). To compute the after-tax cost of debt (3.31 percent), it was used the effective tax rate applied to the whole group, the effective tax rate. For 2021, the effective tax rate was 23.30 percent.

Weighted Average Cost of Capital (WACC)

Finally, the estimation of Volkswagen’s capital structure is the last missing input to compute the WACC. As addressed in the Literature Review, the cost of equity and debt should be weighted at their market values.

To estimate the market value of equity, it was addressed the number of outstanding shares and its current share price. According to Thomson Reuters, Volkswagen’s preferred and ordinary stocks closed 2021 trading at 177.48 EUR and 258.4 EUR, respectively. In line with Volkswagen 2021 Annual Report there were outstanding around 206 million preferred shares and 295 million ordinary shares. As a result, the market value of equity on December 31st of 2021 was 112 849 million euros.

The company’s debt structure is composed of publicly traded securities, such as bonds, commercial paper and notes, and non-publicly traded liabilities, such as liabilities to banks, lease liabilities and other non-publicly traded liabilities.

For non-current publicly traded debt, the market value will be used. Regarding the current publicly traded debt, the book value will be used since the market value for short-term debt almost coincides with their book value. Lastly, for the non-publicly traded liabilities the book value will be applied. According to Thomson Reuters, on 22nd December 2022, Volkswagen had outstanding 106 843 million euros in non-current debt. 100 534 million euros is the total of the other debt instruments. Altogether, Volkswagen’s debt value was 207 377 million euros.

As stated in the Literature Review, companies that has accumulated a lot of cash, the net debt gives a more accurate WACC. In 2021, cash and cash equivalents amounted 62 255 million euros and therefore, net debt was 145 122 million euros.

Given the estimated market value of equity and debt, Volkswagen’s enterprise value is divided into 56.3 percent of debt and 43.7 percent of equity. Finally, having estimated all the required inputs, the weighted average cost of capital of Volkswagen is the following:

WACC	
E / (E + D)	0.44
Cost of Equity	9.22%
D / (E + D)	0.56
After-tax Cost of Debt	3.31%
	5.89%

FIGURE 18. Weighted Average Cost of Capital, Source: Own calculations

8.1.2. Free Cash Flows

The input variables to reach the Free Cash Flow to the Firm were explained in the previous chapter. After reaching EBIT in the Income Statement, it is necessary to remove non-cash operational expenses, and therefore, add the amortization and depreciation of intangible and tangible assets to EBIT, achieving the EBITDA. Then, it is necessary to take into consideration the necessary investments in operational assets, the working capital, and the necessary capital expenditures in intangible and tangible assets. Therefore, increases in the working capital and the capital expenditures made in the year are removed from EBITDA. Finally, it is also necessary to compute the corporate tax over EBIT. Figure 20 shows the Free Cash Flow to the Firm for the forecasted period, 2022-2027.

Free Cash Flows to the Firm	2022	2023	2024	2025	2026	2027
EBIT	20 921	20 939	21 001	20 816	20 230	19 323
(+) Amort. of Intangible Assets	3 589	3 909	4 238	4 578	4 927	5 281
(+) Depr. of Property, Plant and Equipment	8 936	9 451	9 983	10 531	11 093	11 664
(+) Depr. of Investment Property	15	16	16	17	18	18
(+) Depr. of Lease Assets	3 544	3 827	4 118	4 418	4 726	5 038
(+) Depreciation and Amortization	16 084	17 202	18 355	19 544	20 763	22 002
EBITDA	37 006	38 142	39 356	40 360	40 993	41 325
(-) Increases in Inventories	(4 365)	(1 303)	(1 393)	(1 152)	(727)	(381)
(-) Increases in Trade Receivables	(2 159)	(543)	(580)	(480)	(303)	(158)
(-) Increases in Financial Services Receivables	(2 330)	(2 980)	(3 380)	(2 478)	(98)	22
(-) Increases in Other Receivables	(794)	(254)	(271)	(224)	(142)	(74)
(+) Increase in Other Liabilities	495	466	499	412	260	136
(+) Increase in Trade Payables	2 144	791	846	699	441	231
(+) Increase in Other Provisions	948	306	833	335	740	(245)
(-) Increases in Net Working Capital	(6 061)	(3 517)	(3 447)	(2 887)	173	(469)
Operational Cash Flow	30 945	34 625	35 909	37 473	41 166	40 856
(-) CapEx of Intangible Assets	(6 044)	(6 230)	(6 428)	(6 592)	(6 696)	(6 750)
(-) CapEx of Property, Plant and Equipment	(10 791)	(11 122)	(11 476)	(11 769)	(11 954)	(12 050)
(-) CapEx of Investment Property	(38)	(39)	(40)	(41)	(42)	(42)
(-) CapEx of Lease Assets	(6 305)	(6 498)	(6 705)	(6 876)	(6 984)	(7 041)
(-) Capital Expenditures	(23 178)	(23 889)	(24 650)	(25 278)	(25 675)	(25 883)
(-) Taxes on EBIT	(4 875)	(4 879)	(4 893)	(4 850)	(4 714)	(4 502)
	2 893	5 857	6 366	7 344	10 777	10 471

FIGURE 19. Free Cash Flow to the Firm 2022-2027, Source: Own calculations

In 2022, the estimated value for the Free Cash Flow to the Firm was the lowest due to the big jump in revenues expected for that year. Since most rubrics of net working capital and capital expenditures are projected to grow as a percentage of sales revenue, it will have a negative impact on the cash flow to the firm this year. Additionally, the cash flow evolution is a mirror of the company's cyclical behavior. In the first years of the prevision, the cash flow is the poorest, which is in line with the economic outlook. On the other hand, in the final years of the forecasts, the company is beginning to take advantage of market opportunities and improved economic conditions.

After having the Free Cash Flows to the Firms estimated, it is necessary to compute the terminal value. According to the Literature Review, the Terminal Value will be computed based on Gordon Growth Model and for that, a perpetual growth rate, g , is needed. As Volkswagen is a global company and the GDP is one of the main indicators in the output (quantity) of an economy and the CPI is the main indicator in terms of prices, one approach is to do a weighted average of the country's both indicators where the company operates to use as a proxy of the firm growth rate. The perpetual growth rate is hence 2.24% as shown in the figure below. Finally, to determine the terminal value, the 2027 cash flow was used.

<u>Perpetual Growth Rate</u>	<u>Rev 2021</u>	<u>weight</u>	<u>PIB 2027</u>	<u>INF 2027</u>
Germany	42 847	19.19%	1.34%	1.95%
Europe/Other Markets	90 652	40.61%	1.46%	1.85%
North America	36 810	16.49%	1.78%	2.01%
South America	8 632	3.87%	2.40%	5.66%
Asia-Pacific	44 288	19.84%	5.11%	2.77%
		2.24%	2.25%	2.23%

FIGURE 20. Perpetual Growth Rate, Source: IMF and Own calculations

With all the projected cash flows and the terminal value computed, the sum of the present value of both parts is the next step to achieve the Equity Value. This sum gave an enterprise value of 242 395 million euros. After determining the Enterprise Value, it is now possible to reach the Equity Value by considering the effect of Net Debt (that is, the financial debt net of cash and cash equivalents). As shown in figure 22, Volkswagen's Equity value amounted to 97 274 million euros, meaning that the market was overvaluing Volkswagen's stock prices (as estimated above the market capitalization of Volkswagen was 112 849 million euros on December 31st of 2021).

<u>Discounted Cash Flow</u>	<u>2021</u>	<u>2022</u>	<u>2023</u>	<u>2024</u>	<u>2025</u>	<u>2026</u>	<u>2027</u>
Free Cash Flow to the Firm		2 893	5 857	6 366	7 344	10 777	10 471
Terminal Value							292 887
Discount Factor	1.00	0.94	0.89	0.84	0.80	0.75	0.71
PV 2022-2027		34 676 (14%)					
PV Terminal Value		207 720 (86%)					
Enterprise Value	242 395						
(-) Financial Debt	207 377						
(+) Cash	62 255						
Equity Value	97 274						

FIGURE 21. Discounted FCFF Valuation, Source: Own calculations

8.1.3. Sensitivity Analysis

An Equity Valuation requires the use of assumptions in order to apply valuation models. Knowing that in most cases assumptions might not entirely reflect reality, it is a good practice to understand how changes in the different inputs used to construct, in this case, a DCF valuation model, might affect the result generated. As previously mentioned in Literature Review, the Discounted Cash Flow approach is extremely dependent on the perpetual growth rate and the WACC rate and thus, these will be the variables used in this sensitivity analysis. Additionally, is important to point out that beta fluctuations can happen more frequently than changes in other variables of WACC and therefore, it will be analyzed changes in the company's beta.

The Figure below showcases how fluctuations in the WACC, and terminal growth rate influence the equity value generated by the DCF valuation of Volkswagen.

Beta	1	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8
WACC	4.93%	5.15%	5.36%	5.58%	5.80%	6.01%	6.23%	6.45%	6.66%
Perp. growth									
1.24%	99 090	85 127	72 600	61 300	51 055	41 726	33 195	25 364	18 152
1.49%	114 359	98 600	84 563	71 982	60 643	50 370	41 021	32 477	24 639
1.74%	131 948	113 994	98 133	84 021	71 384	60 003	49 701	40 331	31 773
1.99%	152 430	131 752	113 657	97 691	83 500	70 804	59 380	49 047	39 655
2.24%	176 584	152 464	131 590	113 349	97 274	83 001	70 244	58 775	48 409
2.49%	205 493	176 934	152 539	131 462	113 070	96 881	82 523	69 703	58 187
2.74%	240 714	206 285	177 337	152 657	131 370	112 820	96 514	82 068	69 182
2.99%	284 569	242 142	207 149	177 794	152 819	131 313	112 600	96 172	81 634
3.24%	340 676	286 936	243 668	208 085	178 308	153 025	131 292	112 411	95 856

FIGURE 22. Sensitivity Analysis, Source: Own calculations

8.1.4. Other Methodologies

As it is possible to see in Appendix F other intrinsic valuation approaches were estimated.

From the first graph of the appendix, it is possible to conclude a slightly smaller equity value through the Free Cash Flow to Equity approach, 84 294 million euros.

On the other hand, the Discounted Dividend Method produced a different value. From this approach, the equity value reached 60 373 million euros, a negative difference of 38% from the discounted cash flow through the free cash flow to the firm. This can reflect the conservatism of this approach referred to in the Literature Review.

8.2. Relative Valuation

This chapter will address Volkswagen Group's relative value. Although DCF analysis is the most reliable and most used method to value a company, the relative valuation will behave as a complementary analysis to make a more accurate estimate of Volkswagen Group's value. In this chapter, the share price of the firm will be predicted based on the performance of its peers. The findings of this chapter will act as an indicator of the company's performance.

8.2.1. Peer Group

In the same way that the forecasted revenue component is the most significant element when computing the DCF method, the appropriate peer group selection is the critical component of the relative valuation.

As stated in the Literature Review, to be comparable, companies should be chosen from the same industry, which is the automotive industry, more precisely, car manufacturing companies. Thus, Thomson Reuters was used to obtain a list of comparable firms. This collection includes the Thomson Reuters default set as well as several firms that were specifically added, such as Kia, Hyundai, and others.

After having a list of companies within the same industry, it is important to tailor that list in order to reflect companies with comparable capital costs, that is, companies with similar size, growth, risks, diversification levels and financing constraints. The financial

information supplied in the table may be used to interpret these indicators: market capitalization, debt-to-equity ratio (D/E), return on invested capital (ROIC), and gross and EBITDA margin. The graph above displays the adjusted list of comparable companies:

Peer Group	Market Cap (M €)	D/E	ROIC	Gross Margin
Volkswagen AG	66 681	143.6%	5.75	19.2%
Mercedes Benz Group AG	65 798	174.9%	8.67	23.4%
Bayerische Motoren Werke AG	54 990	136.6%	12.92	19.8%
General Motors Co	43 566	183.1%	7.25	16.8%
Volvo AB	35 057	107.4%	14.47	24.1%
Hyundai Motor Co	27 987	145.0%	4.29	18.6%
Ford Motor Co	41 501	284.6%	5.10	12.1%
Ferrari NV	38 620	119.2%	19.64	51.3%
Stellantis NV	42 153	60.1%		20.7%
Honda Motor Co Ltd	38 903	77.4%	4.48	20.5%
Tesla Inc	335 510	22.6%	31.35	25.3%
Kia Corp	18 298	27.5%	11.59	18.5%
Volvo Car AB	12 635	35.8%	8.91	21.4%
Continental AG	11 272	51.2%	6.70	22.9%
Subaru Corp	11 052	23.3%	4.50	18.4%
Renault SA	9 264	225.7%		19.1%
Porsche Automobil Holding SE	7 709	0.0%		

FIGURE 23. Peer Group, Source: Thomson Reuters

It is important to point out that the revenue growth rate was not considered since Thomson Reuters could not give reliable numbers, which may be a shortcoming of this research. Nonetheless, all the enterprises in the initial peer group are mature, with similar growth rates projected (none is in an initial stage of development, where firms usually experience rapid growth).

From the initial list, companies with red values were removed. The size was the first indicator to be considered. Companies with a market capitalization below 25 000 and above 100 000 million euros were excluded. Then, the company's capital structure was assessed and companies with more equity than debt or with three times more debt than equity were omitted. Additionally, the capacity for value creation was measured through the ROIC. Ferrari NV, a luxury car manufacturer company was since its ROIC was higher than that of Volkswagen Group. Finally, the gross margin was used to account for the company's operational efficiency. Due of its lower gross margin, Ford Motor Company was omitted.

The final list comprises 5 comparable companies: Mercedes Benz Group AG, Bayerische Motoren Werke AG, General Motors Co, Volvo AB, and Hyundai Motor Co.

8.2.2. Multiples

Price to earnings ratio (P/E), enterprise value to EBITDA (EV/EBTIDA) and enterprise value to sales (EV/Sales) were the multiples selected for this analysis. As mentioned in the Literature Review, these multiples must be forward-looking. Therefore, NTM (over the next twelve months) multiples were gathered from Thomson Reuters.

Company Name	Forward P/E	EV/EBITDA	EV/Sales
Mercedes Benz Group AG	5.88	6.57	1.08
Bayerische Motoren Werke AG	6.53	6.59	1.00
General Motors Co	6.40	8.23	0.88
Volvo AB	11.06	8.31	1.22
Hyundai Motor Co	5.22	9.21	0.94
Min	5.22	6.57	0.88
Median	6.40	8.23	1.00
Average	7.02	7.78	1.02
Max	11.06	9.21	1.22

FIGURE 24. Peers' Multiples, Source: Thomson Reuters and Own calculations

P/E multiple was the first multiple chosen since it is the most commonly used multiple and yields quality results when applied to a relatively stable firm. EV/EBITDA was also used because EBITDA is the closest accounting figure to the actual operating Cash Flows generated by a company, as items such as depreciation, amortization, interest and taxes are not related to the company's operational costs. Finally, EV/Sales was also taken into consideration.

The results of this technique can be seen in the following table:

Multiples Valuation	Forward P/E	EV/EBITDA	EV/Sales
Net Income	15 380		
EBITDA		36 996	
Revenue			250 200
Median			
Enterprise Value		304 560	251 361
Debt Value		207 377	207 377
Equity Value	98 415	97 183	43 984
Average			
Enterprise Value		287 888	256 342
Debt Value		207 377	207 377
Equity Value	107 923	80 511	48 965

FIGURE 25. Relative Valuation, Source: Own calculations

Although the three multiples applications, the one that will be subject to analyze will be the forward P/E. As stated in the literature review, this is the most suitable multiple for mature and cyclical manufacturing companies. Therefore, it is possible to conclude that the multiple valuation was in line with the DCF analysis, being the intrinsic value between both outputs achieved with the forward P/E analysis.

CHAPTER 9

Share Price and Consensus Estimates

After conducting both approaches, intrinsic and relative valuation, it is time now to analyze the results. In this chapter, it will be analyzed the upside or downside potential for each of the estimated valuation scenarios and then, other analysts' estimates for the company share price is going to be analyzed.

9.1. Share Price and its Upside/Downside Potential

Since the company has two different types of publicly traded shares, ordinary and preferred shares, there is a need to do a proper equity allocation. In order to do this allocation, it was applied the Option Pricing Method (OPM). The OPM is a commonly used method for allocating equity value between common and preferred shares by treating the invested capital as a call option on a company's value which is explained and executed in Appendix G.

In all 9 scenarios, 3 intrinsic valuations and 6 relative valuations, the share price for preferred and ordinary shares was the same. Although the two different types of equity instruments, the advantage that the preferred shareholders have, a dividend of 0.06€ per share higher and a priority of claims, was worthless. Indeed, this 0.06€ difference only accounts for 1.5% of the dividend from 2017 (the worst dividend in the past 5 years) and 0.8% of the dividend from 2021. The outputs of the OPM are presented in the next graph.

<u>Share Price</u>	<u>Equity Value</u>	<u>Share Price</u>
FCFF	97 274	194.04
FCFE	84 294	168.15
DDM	60 373	120.43
Forward P/E (median)	98 415	196.32
(average)	107 923	215.29
EV/EBITDA (median)	97 183	193.86
(average)	80 511	160.61
EV/Sales (median)	43 984	87.74
(average)	48 965	97.68

FIGURE 26. Share Price by scenario, Source: Own calculations

As of 31st December 2021, preferred shares closed the day trading at 177.48 EUR per share and ordinary shares closed at 258.40 EUR per share (source: Thomson Reuters). Given these amounts and the number of outstanding shares, the company's market capitalization was 112 849 million euros.

After having the market capitalization and the share prices at the end of 2021, is possible to compare the obtained share price with the market's share price. As stated in

the Literature Review, the methods chosen were the DCF through FCFF and the relative valuation through forward P/E.

To conclude about the investment decision, it is necessary to compute the upside or downside potential. If there is an upside potential of 10 percent or more, the investment decision will be "to buy", given the comfortable margin of safety. If there is a downside potential higher than 10 percent, the investment decision will be "to sell". Additionally, if the potential move is between -10 and 10 percent, the decision will be "to hold".

Given the market value of each share and the results of the OPM, the potential upside or downside for each scenario can be estimated. According to figure 28, ordinary shares are deemed overvalued whereas preferred shares are deemed undervalued by the market.

As a result, it is recommended to sell ordinary shares and to buy preferred shares. Although in the first scenario the upside potential does not reach the 10% level, the result was close to the margin of safety and given the upside potential retrieved from the relative valuation, it is recommended to buy preferred shares.

<u>Share Price</u>	Share Price	Ord. Potential	Pre. Potential
FCFF	194.04	-24.91%	9.33%
Forward P/E (median)	196.32	-24.02%	10.62%
(average)	215.29	-16.68%	21.30%

FIGURE 27. Share Price upside potential, Source: Own calculations

9.2. Consensus Estimates

A consensus estimate is a forecast of the value of a publicly traded firm based on the aggregate estimations of all equities analysts who have covered the stock. These estimates are not an exact science and are derived from a variety of elements, including access to corporate data, prior financial statements, and market forecasts for the firm's products.

To assess the company's consensus estimates was used Thomson Reuters. This source assesses the consensus estimate by averaging the current value of all analysts' recommendations updated within the last 12 months. This average is therefore standardized from levels 1 to 5, beginning with "Strong Buy" and going through "Buy", "Hold" and "Sell" until "Strong Sell".

According to the source, there were 27 recommendations for preferred shares and just 3 recommendations for ordinary that came from the same analyst and had the same recommendation price as the preferred shares. This can lead to the same conclusion taken from the OPM, that the share price should be the same for both instruments.

Among the 27 recommendations, 66.7 percent of the analysts recommend to buy, 22.2 percent to hold and only 11.1 percent to sell Volkswagen preferred stock. As a consequence, the consensus recommendation for the company stock is 2.2, a "buy" recommendation. The overall target price was 195.21 EUR, which implies an upside potential of 10.0 percent for preferred shares.

CHAPTER 10

Conclusion

Valuation, considered by many the heart of finance, plays a key role in several subjects in the world. However, performing an accurate valuation is dependent on selecting a proper valuation model. According to the results of the Literature Review, it was feasible to conclude that no one valuation model fits every case, but that by understanding the features of each company, it is possible to choose the valuation model that best matches the situation.

Given Volkswagen's profile, a mature and stable company, the primary strategy was the DCF approach derived from the FCFF between 2022 and 2027. This approach is based on both internal and external factors.

Economically speaking, 2022 was distinguished by high levels of inflation triggered by the Russian-Ukraine war and the supply chain bottlenecks prompted by the covid-19 pandemic. Furthermore, the increase in interest rates to combat inflation will squeeze consumption in the next years. Although this economic prognosis, the market for electric vehicles is looked at with good eyes, comprising a $CAGR_{17-30} = 30\%$, and some developments, such as autonomous driving and shared mobility, are expected to disrupt the industry in the near term. Volkswagen introduced NEW AUTO in 2021, a development strategy that would be implemented through 2030, to adapt its business model to market demands.

Having analyzed all this information, financial statements were projected and the intrinsic value was estimated. Throughout the analysis of the cash flows, it is possible to verify the cyclicity characteristic of the company. The cash flows are the poorest in the initial years of the projected horizon, which is consistent with the economic outlook. In the latter years of the forecasts, the corporation is beginning to take advantage of the market opportunities and improved economic conditions. As a result, 86% of the implied Enterprise Value is included in the terminal value.

A relative valuation was conducted to supplement the intrinsic valuation. The relative value was calculated using three multiples, however as the Literature Review suggests, when evaluating cyclical manufacturing companies, which are companies with normalized earnings, P/E multiples should be considered.

Analyzing both approaches, it was achieved a similar equity value. Throughout the DCF analysis, it achieved an equity value of 97 274 million euros and based on the relative valuation, the median forward P/E provided an equity value of 98 415 million euros and the average forward P/E an equity value of 107 923 million euros.

Given the company's equity profile, the OPM was employed to allocate the equity value through preferred and ordinary shares. Although preferred shares have better economic rights than ordinary shares, the OPM considered that these rights are not enough to be advantageous to preferred owners, hence both shares were assigned with the same value. Following DCF, it was reached an intrinsic share price of 194€, implying that the stock market is over valuating ordinary shares and under valuating preferred shares.

Furthermore, based on the consensus estimates, the average intrinsic value was 195.2€, which was in line with the results obtained through the DCF.

To summarize, given the current status of Volkswagen and its prospects for the future, it is expected that it will continue to expand, retaining, if not increasing, its market share. Besides this financial prospect for Volkswagen, it is recommended to sell the company's ordinary shares and to buy the company's preferred shares.

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World Bank 2022 Global Economic Prospects

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Appendix

Appendix A: Financial Statements 2017-2027E

[1] Historical Income Statement

Income Statement (2017-2021)	2017	2018	2019	2020	2021
	Pre-fsct	Pre-fsct	Pre-fsct	Pre-fsct	Fin Close
Sales Revenue	229 550	235 849	252 633	222 884	250 200
Costs of Goods Sold	(186 001)	(189 500)	(203 490)	(183 937)	(202 959)
Gross Margin	43 549	46 349	49 143	38 947	47 241
Gross Result	43 549	46 349	49 143	38 947	47 241
Distribution and Administrative Expenses	(22 700)	(19 760)	(18 411)	(18 082)	(15 678)
Other Operating Expenses	(12 258)	(14 731)	(12 890)	(13 906)	(13 049)
Other Operating Income	11 629	11 629	11 453	12 438	14 731
Operating Expenses	(23 329)	(22 862)	(19 848)	(19 550)	(13 996)
EBITDA	20 220	23 487	29 295	19 397	33 245
Amortization of Intangible Assets	(402)	(2 211)	(3 001)	(3 466)	(4 708)
Depreciation of Tangible Assets	(5 872)	(7 347)	(9 316)	(6 254)	(9 241)
Depreciation of Investment Property	(11)	(11)	(17)	(4)	(21)
Amortization & Depreciation	(6 285)	(9 569)	(12 334)	(9 724)	(13 970)
EBIT	13 935	13 918	16 961	9 673	19 275
Share of the result of equity-accounted investments	3 483	3 369	3 349	2 756	2 320
Interest income	951	967	910	793	810
Interest expenses	(2 317)	(1 547)	(2 524)	(2 291)	(1 818)
RCF Interest expenses	--	--	--	--	--
Other financial result	(2 262)	(1 066)	(339)	733	(463)
Financial result	(145)	1 723	1 396	1 991	849
EBT	13 790	15 641	18 357	11 664	20 124
Current	(3 205)	(3 533)	(4 147)	(3 150)	(4 612)
Deferred	995	43	(180)	307	(86)
Income tax income/expense	(2 210)	(3 490)	(4 327)	(2 843)	(4 698)
Earnings after tax	11 463	12 153	14 029	8 824	15 428
of which attributable to					
Noncontrolling interests	10	17	143	(43)	46
Volkswagen AG hybrid capital investors	274	309	549	533	539
Volkswagen AG shareholders	11 179	11 827	13 346	8 334	14 843

Source: Own calculations

[2] Forecasted Income Statement

Income Statement (2022E-2027E)	2022E	2023E	2024E	2025E	2026E	2027E
	Fsct	Fsct	Fsct	Fsct	Fsct	Fsct
Sales Revenue	278 502	287 052	296 190	303 745	308 512	311 009
Costs of Goods Sold	(229 461)	(236 679)	(244 383)	(250 812)	(254 987)	(257 325)
Gross Margin	49 041	50 373	51 807	52 933	53 525	53 684
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Gross Result	49 041	50 373	51 807	52 933	53 525	53 684
Distribution and Administrative Expenses	(17 451)	(17 987)	(18 560)	(19 033)	(19 332)	(19 488)
Other Operating Expenses	(14 525)	(14 971)	(15 448)	(15 842)	(16 090)	(16 220)
Other Operating Income	16 397	16 901	17 439	17 884	18 164	18 311
Operating Expenses	(15 579)	(16 057)	(16 569)	(16 991)	(17 258)	(17 398)
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EBITDA	33 461	34 315	35 238	35 942	36 267	36 286
Amortization of Intangible Assets	(3 589)	(3 909)	(4 238)	(4 578)	(4 927)	(5 281)
Depreciation of Tangible Assets	(8 936)	(9 451)	(9 983)	(10 531)	(11 093)	(11 664)
Depreciation of Investment Property	(15)	(16)	(16)	(17)	(18)	(18)
Amortization & Depreciation	(12 540)	(13 376)	(14 237)	(15 126)	(16 038)	(16 963)
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EBIT	20 921	20 939	21 001	20 816	20 230	19 323
Share of the result of equity-accounted investments	4 543	4 951	5 439	6 061	6 639	7 128
Interest income	2 003	2 406	2 373	2 491	2 641	2 710
Interest expenses	(8 626)	(10 386)	(9 503)	(9 314)	(9 440)	(9 356)
RCF Interest expenses	(90)	(322)	(479)	(623)	(604)	(391)
Other financial result	(679)	(363)	(222)	(199)	(385)	(370)
Financial result	(2 849)	(3 714)	(2 393)	(1 583)	(1 149)	(279)
<hr/>						
EBT	18 072	17 226	18 608	19 233	19 081	19 044
Income tax expense	(4 211)	(4 014)	(4 336)	(4 481)	(4 446)	(4 437)
<hr/>						
Earnings after tax	13 861	13 212	14 272	14 752	14 635	14 607
<hr/>						
of which attributable to						
Noncontrolling interests	41	39	43	44	44	44
Volkswagen AG hybrid capital investors	554	528	571	590	585	584
Volkswagen AG shareholders	13 266	12 645	13 659	14 118	14 006	13 980

Source: Own calculations

[3] Balance Sheet Assets

Balance Sheet Statement (2017-2027E)		2017	2018	2019	2020	2021	2022E	2023E	2024E	2025E	2026E	2027E
		Pre-fsct	Pre-fsct	Pre-fsct	Pre-fsct	Fin Close	Fsct	Fsct	Fsct	Fsct	Fsct	Fsct
Non Current Assets		262 079	274 623	300 604	302 164	328 257	386 429	348 951	362 322	374 401	381 766	387 168
Fixed Assets												
	Intangible assets	63 418	64 611	66 210	67 964	77 685	80 140	82 461	84 651	86 665	88 434	89 903
	Property, plant and equipment	55 242	57 631	66 153	63 883	63 695	65 550	67 221	68 715	69 953	70 813	71 199
	Investment property	469	496	538	558	615	638	661	684	709	733	756
Financial Assets												
	Equity-accounted investments	8 205	8 434	8 169	10 079	12 531	13 421	14 626	16 068	17 907	19 613	21 057
	Other equity investments	1 319	1 475	1 902	1 864	2 998	3 363	3 734	4 174	4 591	5 125	5 459
	Other financial assets	8 454	6 522	5 552	7 835	9 157	7 504	7 314	7 472	7 856	7 861	7 602
Operational Assets												
	Lease assets	39 254	43 546	48 938	50 686	59 699	62 460	65 131	67 719	70 177	72 436	74 438
	Financial services receivables	73 249	78 693	86 973	82 565	84 954	86 119	90 468	95 400	99 017	99 170	99 144
	Other receivables	2 252	2 608	2 722	2 868	2 895	3 207	3 306	3 411	3 498	3 553	3 582
Tax Assets												
	Deferred tax assets	9 810	10 131	13 106	13 486	13 393	13 393	13 393	13 393	13 393	13 393	13 393
	Tax receivables	407	476	341	376	635	635	635	635	635	635	635
Current Assets		160 115	183 535	187 463	194 943	200 347	209 060	214 205	219 990	224 390	225 535	226 108
Financial Assets												
	Other financial assets	11 998	11 586	12 216	13 234	12 584	12 324	12 389	12 549	12 616	12 492	12 474
	Assets held for sale	115	--	797	--	675	--	--	--	--	--	--
Operational Assets												
	Inventories	40 416	45 745	46 741	43 823	43 724	48 089	49 392	50 785	51 937	52 664	53 045
	Trade receivables	13 358	17 888	17 941	16 244	15 520	17 679	18 221	18 801	19 281	19 584	19 742
	Financial services receivables	53 146	54 216	58 615	58 005	56 498	58 828	61 809	65 189	67 667	67 764	67 742
	Other receivables	5 346	6 204	7 272	7 381	7 473	8 267	8 521	8 792	9 016	9 158	9 232
Tax Assets												
	Tax receivables	1 339	1 879	1 190	1 186	1 618	1 618	1 618	1 618	1 618	1 618	1 618
Net Debt Assets												
	Marketable securities	15 939	17 079	16 769	21 161	22 532	22 532	22 532	22 532	22 532	22 532	22 532
	Cash, cash equivalents and time deposits	18 458	28 938	25 922	33 909	39 723	39 723	39 723	39 723	39 723	39 723	39 723
	Retained Cash	--	--	--	--	--	--	--	--	--	--	--
Total assets		422 194	458 158	488 067	497 107	528 604	545 489	563 156	582 312	598 791	607 301	613 276

Source: Own calculations

[4] Balance Sheet Liabilities

Balance Sheet Statement (2017-2027E)		2017	2018	2019	2020	2021	2022E	2023E	2024E	2025E	2026E	2027E
		Pre-fsct	Pre-fsct	Pre-fsct	Pre-fsct	Fin Close	Fsct	Fsct	Fsct	Fsct	Fsct	Fsct
Equity		109 078	117 343	123 551	128 784	146 152	157 251	167 321	178 660	190 084	201 012	211 974
Noncontrolling												
Noncontrolling interests		228	226	1 869	1 734	1 705	1 746	1 786	1 828	1 872	1 916	1 959
VW AG Shareholders and hybrid capital investors												
Subscribed capital		1 283	1 283	1 283	1 283	1 283	1 283	1 283	1 283	1 283	1 283	1 283
Capital reserve		14 551	14 551	14 551	14 551	14 551	14 551	14 551	14 551	14 551	14 551	14 551
Retained earnings		81 249	91 105	96 929	100 772	117 341	127 430	136 860	147 533	158 263	168 473	178 689
Other reserves		678	(2 418)	(3 645)	(5 269)	(3 167)	(2 775)	(2 775)	(2 775)	(2 775)	(2 775)	(2 775)
Equity attributable to VW AG hybrid capital investors		11 089	12 596	12 664	15 713	14 439	15 016	15 616	16 241	16 890	17 565	18 267
Non-Current Liabilities		152 726	172 845	196 495	202 922	218 061	223 012	228 662	234 011	237 560	233 573	228 795
Financial Liabilities												
Other financial liabilities		2 664	3 219	4 500	4 256	4 466	3 821	4 052	4 219	4 163	4 144	4 080
Provisions for pensions		32 730	33 097	41 389	45 081	41 550	41 550	41 550	41 550	41 550	41 550	41 550
Operational Liabilities												
Other liabilities		6 200	6 448	7 271	7 906	8 431	9 126	9 354	9 598	9 799	9 926	9 993
Other provisions		20 839	20 879	21 782	22 688	23 474	24 013	24 888	25 973	26 325	26 488	26 774
Financial Debt												
Financial liabilities		81 627	101 125	113 555	114 809	131 617	131 617	131 617	131 617	131 617	131 617	131 617
RCF Financial Liabilities		--	--	--	--	--	4 362	8 678	12 531	15 582	11 325	6 258
Tax Liabilities												
Deferred tax liabilities		5 636	5 030	5 007	4 890	5 131	5 131	5 131	5 131	5 131	5 131	5 131
Provisions for taxes		3 030	3 047	2 991	3 292	3 392	3 392	3 392	3 392	3 392	3 392	3 392
Current Liabilities		160 390	167 968	167 923	165 411	164 392	165 227	167 174	169 642	171 149	172 717	172 508
Financial Liabilities												
Other financial liabilities		8 570	9 416	10 858	10 590	13 002	10 487	10 871	11 162	11 222	11 349	11 018
Liabilities associated with assets held for sale		--	--	370	--	238	--	--	--	--	--	--
Put options and compensation rights		3 795	1 853	--	--	--	--	--	--	--	--	--
Operational Liabilities												
Other liabilities		15 961	17 593	19 320	17 980	19 889	20 384	20 851	21 349	21 762	22 022	22 158
Trade payables		23 046	23 607	22 745	22 675	23 624	25 768	26 559	27 405	28 104	28 545	28 776
Other provisions		25 347	23 874	24 434	22 964	25 578	26 526	26 832	27 665	28 000	28 740	28 495
Financial Debt												
Financial liabilities		81 844	89 757	87 912	88 649	78 584	78 584	78 584	78 584	78 584	78 584	78 584
Tax Liabilities												
Provisions for taxes		1 397	1 412	1 876	2 213	2 863	2 863	2 863	2 863	2 863	2 863	2 863
Tax payables		430	456	408	340	614	614	614	614	614	614	614
Total equity and liabilities		422 194	458 156	488 069	497 117	528 605	545 490	563 157	582 313	598 792	607 302	613 277

Source: Own calculations

[5] Historical Cash Flow Statement

Cash Flow Statement (2017-2021)	2017	2018	2019	2020	2021
	Pre-fsct	Pre-fsct	Pre-fsct	Pre-fsct	Fin Close
Cash and cash equivalents at beginning of period	18 833	18 038	28 113	24 329	33 432
Cash flows from operating activities	8 259	8 033	16 337	24 902	38 635
Earnings before tax	13 913	15 643	18 356	11 667	20 126
Income taxes paid	(3 664)	(3 804)	(2 914)	(2 646)	(4 216)
D&A of, and impairment losses on, int. assets, PPE, and inv. property, net	10 562	11 034	12 046	12 765	12 947
Amortization of and impairment losses on capitalized development costs, net	3 734	3 668	3 665	4 637	5 050
Impairment losses on equity investments, net	136	170	300	454	137
Depreciation of and impairment losses on lease assets, net	7 734	7 689	8 428	9 214	9 339
Gain/Loss on disposal of non current assets and equity investments	(25)	98	(4)	(869)	180
Change in pension provisions				806	992
Share of the result of equity-accounted investments	274	244	460	536	787
Other non cash expense/income and reclassifications	(480)	347	(730)	(1 572)	(1 652)
Change in inventories	(4 198)	(5 372)	(674)	1 334	2 110
Change in receivables (excluding financial services)	(1 660)	(6 400)	(893)	712	1 888
Change in liabilities (excluding financial liabilities)	5 302	3 645	2 297	540	1 856
Change in provisions				(2)	951
Change in lease assets	(11 478)	(11 647)	(13 204)	(12 914)	(16 205)
Change in financial services receivables	(11 891)	(7 282)	(10 796)	260	4 345
Cash flows from investing activities	(16 508)	(21 591)	(21 146)	(22 691)	(26 128)
Investments in intangible assets (excluding development costs), PPE, and inv	(13 052)	(13 729)	(14 230)	(11 273)	(10 655)
Additions to capitalized development costs	(5 260)	(5 234)	(5 171)	(6 473)	(7 843)
Acquisition of subsidiaries	(277)	(470)	(673)	26	(3 158)
Acquisition of other equity investments	(561)	(420)	(420)	(1 660)	(2 741)
Disposal of subsidiaries	496	(26)	3	402	(304)
Disposal of other equity investments	24	210	177	195	52
Proceeds from disposal of intangible assets, PPE, and investment property	411	282	237	411	469
Change in investments in securities	1 376	(1 378)	387	(4 462)	(1 281)
Change in loans and time deposits	335	(826)	(1 456)	143	(667)
Cash flows from financing activities	17 624	24 565	(865)	7 637	(7 755)
Capital contributions/capital redemptions	3 473	1 491	--	2 984	(1 071)
Dividends paid	(1 332)	(2 375)	(2 899)	(2 952)	(3 022)
Capital transactions with noncontrolling interest shareholders	--	(28)	1 368	(238)	(590)
Proceeds from issuance of bonds	30 279	35 308	25 916	25 181	32 659
Repayment of bonds	(17 877)	(15 290)	(19 784)	(19 815)	(30 557)
Changes in other financial liabilities	3 109	5 488	(4 509)	3 577	(3 928)
Repayment of lease liabilities	(28)	(29)	(957)	(1 100)	(1 246)
Effect of exchange rate changes on cash and cash equivalents	(727)	(173)	243	(745)	942
Change of loss allowance within cash and cash equivalents	--	(1)	1	--	(1)
Net change in cash and cash equivalents	(795)	10 071	(3 784)	9 102	5 693
Cash and cash equivalents at end of period	18 038	28 109	24 329	33 431	39 125
Securities, loans and time deposits	26 291	28 036	29 099	32 645	34 515
Gross liquidity	44 329	56 145	53 428	66 076	73 640
Total third-party borrowings	(163 472)	(190 883)	(201 468)	(203 457)	(210 213)
Net liquidity	(119 143)	(134 738)	(148 040)	(137 381)	(136 573)

Source: Own calculations

[6] Projected Cash Flow Statement

Cash Flow Statement (2022E-2027E)	2022E	2023E	2024E	2025E	2026E	2027E
	Fsct	Fsct	Fsct	Fsct	Fsct	Fsct
Cash Flow from Operating Activities	20 186	20 769	21 160	22 964	29 817	29 728
EBIT	20 921	20 939	21 001	20 816	20 230	19 323
Depreciation, Amortization & Impairments						
Amortization and Impairments of Intangible Assets	3 589	3 909	4 238	4 578	4 927	5 281
Depreciation and Impairments of Tangible Assets	8 936	9 451	9 983	10 531	11 093	11 664
Depreciation and Impairments of Investment Property	15	16	16	17	18	18
Depreciation and Impairments of LA	3 544	3 827	4 118	4 418	4 726	5 038
Working Capital Changes						
(Increase)/Decrease in Inventories	(4 365)	(1 303)	(1 393)	(1 152)	(727)	(381)
(Increase)/Decrease in Trade Receivables	(2 159)	(543)	(580)	(480)	(303)	(158)
(Increase)/Decrease in Financial Services Receivables	(2 330)	(2 980)	(3 380)	(2 478)	(98)	22
(Increase)/Decrease in Other Receivables	(794)	(254)	(271)	(224)	(142)	(74)
(Increase)/Decrease in Tax Receivables	--	--	--	--	--	--
Increase/(Decrease) in Other Liabilities	495	466	499	412	260	136
Increase/(Decrease) in Trade Payables	2 144	791	846	699	441	231
Increase/(Decrease) in Other Provisions	948	306	833	335	740	(245)
Increase/(Decrease) in Provisions for Taxes	--	--	--	--	--	--
Increase/(Decrease) in Tax Payables	--	--	--	--	--	--
Other Changes in Operational Activities						
(Increase)/Decrease in Lease Assets	(6 305)	(6 498)	(6 705)	(6 876)	(6 984)	(7 041)
(Increase)/Decrease in Noncurrent Financial Services Recv	(1 165)	(4 349)	(4 931)	(3 617)	(153)	26
(Increase)/Decrease in Noncurrent Other Receivables	(312)	(98)	(105)	(87)	(55)	(29)
(Increase)/Decrease in Noncurrent Tax Receivables	--	--	--	--	--	--
Increase/(Decrease) in Provisions for Pensions	--	--	--	--	--	--
Increase/(Decrease) in Noncurrent Other Liabilities	695	228	244	201	127	67
Increase/(Decrease) in Noncurrent Other Provisions	539	875	1 085	352	163	287
(Increase)/Decrease in Provision for taxes	--	--	--	--	--	--
Taxes paid						
Corporate Income Tax	(4 211)	(4 014)	(4 336)	(4 481)	(4 446)	(4 437)
(Increase)/Decrease in Deferred Tax Assets	--	--	--	--	--	--
Increase/(Decrease) in Deferred Tax Liabilities	--	--	--	--	--	--
Cash Flow from Investing Activities	(14 394)	(13 277)	(14 249)	(15 043)	(14 065)	(13 610)
Capital Expenditures (net of disposals)						
Additions on Intangible Assets	(6 044)	(6 230)	(6 428)	(6 592)	(6 696)	(6 750)
Additions on Tangible Assets	(10 791)	(11 122)	(11 476)	(11 769)	(11 954)	(12 050)
Additions on Investment Property	(38)	(39)	(40)	(41)	(42)	(42)
Other Changes in Investing Activities						
Changes in Equity-accounted Investments	(890)	(1 205)	(1 442)	(1 839)	(1 706)	(1 444)
Changes in Other Equity Investments	(365)	(372)	(440)	(417)	(534)	(334)
Changes in Noncurrent Other Financial Assets	1 653	190	(158)	(384)	(4)	259
Changes in Current Other Financial Assets	260	(65)	(161)	(67)	124	18
Changes in Assets held for sale	675	--	--	--	--	--
Change in Noncurrent Other Financial Liabilities	(645)	231	167	(56)	(19)	(64)
Change in Current Other Financial Liabilities	(2 515)	383	291	61	126	(331)
Changes in Liabilities associated with assets held for sale	(238)	--	--	--	--	--
Share of the result of equity-accounted investments	4 543	4 951	5 439	6 061	6 639	7 128
Cash Flow from Financing Activities	(10 154)	(11 807)	(10 765)	(10 972)	(11 495)	(11 051)
Financial Debt						
Change in Noncurrent Financial Debt	--	--	--	--	--	--
Change in Current Financial Debt	--	--	--	--	--	--
Interest Income	2 003	2 406	2 373	2 491	2 641	2 710
Interest Expenses	(8 626)	(10 386)	(9 503)	(9 314)	(9 440)	(9 356)
RCF Interest expenses	(90)	(322)	(479)	(623)	(604)	(391)
Cash & Cash Equivalents						
Change in Marketable Securities	--	--	--	--	--	--
Change in Cash and Cash Equivalents	--	--	--	--	--	--
Other financial result	(679)	(363)	(222)	(199)	(385)	(370)
Equity movements						
Dividends Paid	(3 772)	(3 782)	(3 600)	(4 022)	(4 426)	(4 391)
Changes in VW AG Hybrid Capital Investors	577	600	624	649	675	702
Changes in Noncontrolling Investors	41	39	43	44	44	44
Other movements in Equity	392	--	--	--	--	--
Cash Generated/(Cash Needs) – Before RCF	(4 362)	(4 315)	(3 854)	(3 051)	4 258	5 067

Source: Own calculations

Appendix B: Macroeconomic Assumptions

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022E	2023E	2024E	2025E	2026E	2027E
	Pre-fsct	Pre-fsct	Pre-fsct	Pre-fsct	Pre-fsct	Pre-fsct	Pre-fsct	Pre-fsct	Pre-fsct	Pre-fsct	Pre-fsct	Pre-fsct	Pre-fsct	Fin Close	Fsct	Fsct	Fsct	Fsct	Fsct	Fsct
Oil Prices	35.91%	-36.56%	28.70%	31.39%	-0.13%	-0.12%	-9.19%	-45.97%	-14.95%	22.30%	25.14%	-7.46%	-31.67%	65.95%	41.45%	-12.90%	-6.22%	-4.92%	-3.90%	-3.11%
GDP																				
Europe	0.41%	-4.50%	2.13%	1.68%	-0.87%	-0.24%	1.39%	2.02%	1.86%	2.62%	1.79%	1.59%	-6.09%	5.24%	3.06%	0.50%	1.79%	1.94%	1.73%	1.46%
Germany	0.96%	-5.70%	4.19%	3.91%	0.43%	0.43%	2.22%	1.49%	2.23%	2.68%	0.98%	1.05%	-3.69%	2.63%	1.55%	-0.29%	1.50%	2.16%	1.82%	1.34%
EUA	0.12%	-2.60%	2.71%	1.55%	2.28%	1.84%	2.29%	2.71%	1.67%	2.26%	2.92%	2.29%	-3.41%	5.67%	1.64%	1.00%	1.21%	1.76%	2.05%	1.86%
Brazil	5.09%	-0.13%	7.53%	3.97%	1.92%	3.01%	0.50%	-3.55%	-3.28%	1.32%	1.78%	1.22%	-3.88%	4.62%	2.79%	1.03%	1.91%	2.00%	1.97%	1.99%
China	9.59%	9.45%	10.61%	9.55%	7.85%	7.77%	7.39%	7.02%	6.85%	6.95%	6.75%	5.95%	2.44%	8.08%	3.11%	4.44%	4.50%	4.63%	4.60%	4.63%
Inflation																				
Europe	3.27%	0.29%	1.62%	2.71%	2.50%	1.35%	0.43%	0.19%	0.24%	1.54%	1.76%	1.20%	0.25%	2.59%	8.31%	5.74%	2.74%	2.19%	1.91%	1.85%
Germany	2.75%	0.25%	1.12%	2.48%	2.16%	1.61%	0.77%	0.68%	0.37%	1.70%	1.94%	1.35%	0.37%	3.21%	8.46%	7.19%	3.53%	2.56%	1.99%	1.95%
EUA	3.82%	-0.32%	1.64%	3.14%	2.07%	1.47%	1.62%	0.12%	1.27%	2.13%	2.44%	1.81%	1.25%	4.69%	8.05%	3.51%	2.23%	2.04%	2.01%	2.04%
Brazil	5.68%	4.89%	5.04%	6.64%	5.40%	6.20%	6.33%	9.03%	8.74%	3.45%	3.67%	3.73%	3.21%	8.30%	9.41%	4.68%	3.93%	3.02%	2.96%	3.03%
China	5.90%	-0.70%	3.30%	5.40%	2.65%	2.62%	1.99%	1.44%	2.00%	1.56%	2.11%	2.90%	2.39%	0.85%	2.17%	2.24%	1.86%	2.00%	2.00%	2.00%

Source: IMF

Appendix C: Financial Statements Assumptions

[1] Income Statement Assumptions

Assumptions	
COGS (COGS + Depreciation Lease Assets)	
Cost of Goods Sold	<i>last year as a % of sales</i>
Depreciation Lease Assets	<i>Explained below</i>
Other Operational Costs	
Administrative & Distribution Expenses	<i>last year (- D&A) as a % of sales</i>
Other Operating Expenses	<i>last year as a % of sales</i>
Other Operating Income	<i>last year as a % of sales</i>
Financial Results	
Share of the result of equity-accounted investments	<i>last year as a % of Equity-accounted Investments balance</i>
Interest income	<i>explained Chapter 7</i>
Interest expenses	<i>explained Chapter 7</i>
Other financial result	<i>moving average last 5y (€)</i>
Income Taxes	
Income tax income/expense	<i>explained Chapter 7</i>

Source: Own calculations

[2] Balance Sheet Assumptions

Assumptions

Fixed Assets

Intangible assets, PPE, Investment Property, Equity Investments (excl. goodwill and payments...)	
Additions (CapEx)	simple average last 5y additions as a % of revenues
Additions (D&A/Impairments)	simple average last 5y additions as a % of asset's gross value
Goodwill	
Additions (CapEx)	0 €
Additions (Impairments)	simple average last 5y additions as a % of asset's gross value
Payments on account and assets under construction	
Additions (CapEx)	0 €
Additions (Impairments)	0 €
Lease Assets	
Additions (CapEx)	simple average last 5y additions as a % of revenues
Additions (Depreciation)	last year addition as a % of asset's gross value

Operational Assets

Inventories	
Raw materials, consumables and supplies	last year as a % of COGS
Work in progress	last year as a % of COGS
Finished goods and purchased merchandise	last year as a % of COGS
Current lease assets	last year (€)
Prepayments	last year (€)
Hedges on inventories	last year (€)
Trade Receivables	last year as a % of sales
Financial Services Receivables	last year as a % of sales
Other Receivables	last year as a % of sales
Trade Payables	last year as a % of COGS
Other Liabilities	
Payments received on account of orders	last year as a % of sales
Liabilities relating to other taxes	last year (€)
Liabilities relating to social security	last year as a % of Administration and Distribution Expenses
Liabilities relating to wages and salaries	last year as a % of Administration and Distribution Expenses
Miscellaneous liabilities	last year (€)

Financial Assets

Other Financial Assets & Liabilities	moving average last 5y (€)
Assets held for sale	0 €
Liabilities associated with assets held for sale	0 €
Put options and compensation rights	0 €
Provisions for Pensions	last year (€)
Other Provisions	
Obligations arising from Sales	moving average as a % of sales
Employee Expenses	moving average as a % of Administration and Distribution Expenses
Litigation and Legal Risks	moving average last 5y (€)
Miscellaneous Provisions	moving average last 5y (€)

Net Debt

Noncurrent Financial Liabilities	last year (€)
Current Financial Liabilities	last year (€)
Marketable Securities	last year (€)
Cash, Cash equivalents and Deposits	last year (€)

Tax

Deferred tax assets & liabilities	last year (€)
Tax receivables & payables	last year (€)
Provisions for taxes	last year (€)

Equity

Subscribed Capital	last year (€)
Capital Reserve	last year (€)
Other Reserves	simple average last 5y (€)
Equity to VW AG Hybrid Capital investors	simple average as a % of distributed earnings to Hybrid inv.
Noncontrolling interests	last year as a % of distributed earnings to noncontrolling
Dividends	gradual growth until payout ratio goal 30% in 2025

Source: Own calculations

Appendix D: Sales Revenue Estimation (Multiple Linear Regression Model)

“Quantitative techniques can and should be used where appropriate in a valuation to arrive at a more sound, logical and well supported conclusions. A case in point is the use of linear regression analysis, a statistical technique that helps discern possible relationships between two or more variables” (Hawkins, 2008 [20]).

Regression attempts to discern relationship between things, called variables. The variable to be predicted is the dependent variable (y) and its value will be dependent on the independent variables (x_j , with $j=1, \dots, n$). The linear relationship will be then presented as follow:

$$Y_i = \beta_1 + \beta_2 X_{2i} + \dots + \beta_n X_{ni} \quad (10.1)$$

For each independent variable, there will be a β coefficient. The coefficients are some of the model parameters that will be estimated using data on the dependent and independent variables. Each coefficient measures the effect that a change in its independent variable will have upon Y .

The linear regression can be based on a Simple Linear Regression Model, employing only one explanatory variable, or a Multiple Linear Regression Model, employing more than one explanatory variable.

To infer the validity of these models, there are several tests and indicators to look at. In this dissertation, it was made 3 tests and it was taken into consideration 1 indicator.

All of the following insights were taken from Dias Curto (2020) [12].

[1] Original Regression

As explained in Chapter 7, quarterly regressions were regressed for each geography, with seven explanatory variables considered for each regression: the four previous quarters, the evolution of the gross domestic product and the consumer price index for each geography, and the evolution of the oil average price.

In order to assess the model’s validity, the F-Test and the Adjusted R-Squared were taken into consideration.

The F-test of overall significance indicates whether the linear regression model provides a better fit to the data than a model that contains no independent variables. This test allows to understand if the explanatory variables are globally statistically significant or not and if no independent variable contribute to explain the total variation of Volkswagen’s sales revenue.

$$H_0 : \beta_j = 0$$
$$H_1 : \exists \beta_j \neq 0$$

After running the test, a p-value will be obtained. The p-value is a statistical metric used to test a hypothesis against observed data. If the p-value exceeds the confidence interval, the null hypothesis is not rejected and the dependent variable Y is pure randomness and has no regard for the values of the X variables. If the contrary happens, at

least one of the explanatory variables is statistically significant and is useful to predict the behavior of the dependent variable.

The R-Squared statistic is used to determine how effectively a regression model predicts outputs for new observations. This indicator is represented by a number between 0 and 1, with 1 indicating perfect correlation and 0 indicating no connection. The adjusted R-squared is a version of R-squared that has been changed to account for the number of predictors in the model. While the r-squared rises as the number of explanatory factors increase (even if the additional explanatory variables do not enhance the model), adjusted R-squared improves only when the new terms improve the model.

After validating these two first parameters, the RESET test was executed. The RESET Test (Regression Specification Error Test) determines the occurrence of three types of specification errors: omission of relevant explanatory variables, incorrect functional form, and correlation between explanatory variables and model errors; in other words, it determines whether or not the model is well-specified. The hypotheses of the test are:

$$H_0 : \epsilon \sim N(0, \sigma^2 I)$$

$$H_1 : \epsilon \sim N(\mu, \sigma^2 I), \mu \neq 0$$

If the model is properly specified, any nonlinear function of the explanatory variables introduced must be statistically insignificant. This said the purpose of the test is to rearrange the model obtained, including nonlinear forms of the explanatory variables in this form:

$$y = X\beta + \delta_1 \hat{y}^2 + \dots + \delta_i \hat{y}^{i+1} + \epsilon$$

With this test, is possible to check whether the estimates for δ_i , $i = 2, 3, \dots, 9$, are statistically significant. If this is true, it is possible to conclude that nonlinear functions of the explanatory variables have been omitted from our model. In the null hypothesis, it was considered that the model is correctly specified, which is:

$$H_0 : \delta_i = 0$$

$$H_1 : \exists \delta_i \neq 0$$

One of the problems of this test is that it does not give insights on how to proceed in case of rejecting the null hypothesis. In order to avoid this problem, an alternative path was considered to proceed with the model, assuming that there might be a spurious regression between the variables assumed, explained by an external factor.

This said the variable \hat{y}^2 was included in every model, recognizing that the first sub-sample cannot be described by a linear model on its own. With this approach, it was possible to “simulate” a linear relationship between the explanatory variables and the dependent one.

The obtained results for the F-test, the Adjusted R-squared and RESET test are shown in the next figure:

	<u>F-test</u>	<u>Adj. R-Sq.</u>	<u>fitted^2</u>
<u>Europe & Other Markets</u>			
Q1	0.000	0.920	0.574
Q2	0.009	0.757	0.008
Q3	0.000	0.955	0.425
Q4	0.000	0.963	0.427
<u>North America</u>			
Q1	0.000	0.979	0.310
Q2	0.000	0.923	0.088
Q3	0.000	0.974	0.796
Q4	0.000	0.986	0.338
<u>South America</u>			
Q1	0.014	0.720	0.645
Q2	0.008	0.766	0.667
Q3	0.013	0.731	0.760
Q4	0.037	0.673	0.100
<u>Asia Pacific</u>			
Q1	0.000	0.913	0.224
Q2	0.000	0.913	0.465
Q3	0.001	0.871	0.139
Q4	0.000	0.937	0.363

Source: Own calculations

As can be seen from figure above, every model has a good fit and at least one explanatory variables statistically significant. Regarding the RESET test, it can be concluded that only one regression is not well specified. However, given its high goodness of fitness and the result obtained with the F-test it was assumed that this problem won't be significant in this research.

[2] Adjusted Model

After analysing the general specificities of the original regression it is now time to remove explanatory variables that are not significant to each model. In order to perform this adjustment, the t-test was computed. While F-test measures the global significance of the model, the t-test measures the individual significance. The hypothesis under this test are:

$$H_0 : \beta_i = 0$$

$$H_1 : \exists \beta_i \neq 0$$

After running the test, the p-value will be analyzed. The conclusions from the p-value will be the same as the ones gathered from the F-test: if the p-value exceeds the confidence interval, the null hypothesis is not rejected; if the contrary happens, the null hypothesis is rejected.

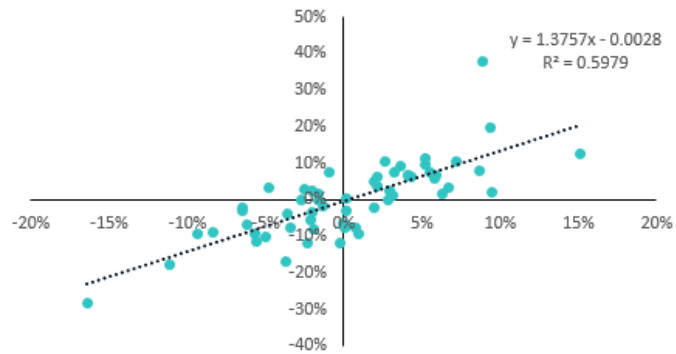
Since there are a lot of variables and a lot of regressions, it won't be showed all the p-value for each value. Instead, the final regressions and the Adjusted R-Squared and the p-value of F-test of these final regressions are shown in Figure 15 in Chapter 7.

Appendix E: Cost of Equity and Cost of Debt

[1] Beta Calculation

VOWG_p.DE Beta

Regression Statistics	
Multiple R	0.773
R Square	0.598
Adjusted R Square	0.591
Standard Error	0.064
Observations	59



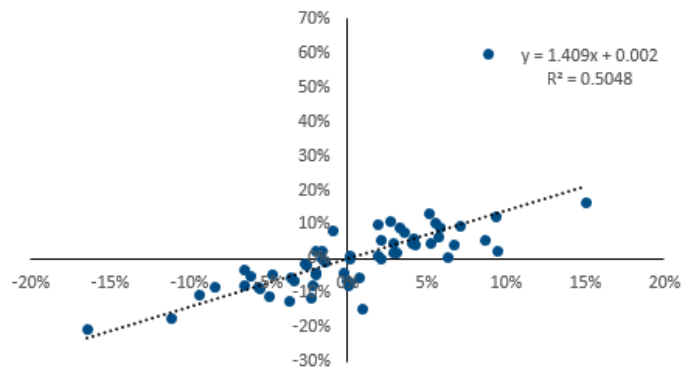
ANOVA					
	df	SS	MS	F	Significance F
Regression	1	0.346	0.346	84.756	0.000
Residual	57	0.233	0.004		
Total	58	0.579			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	-0.003	0.008	-0.332	0.741	-0.019	0.014	-0.019	0.014
r DAX	1.376	0.149	9.206	0.000	1.076	1.675	1.076	1.675

Source: Own calculations

VOWG.DE Beta

Regression Statistics	
Multiple R	0.710
R Square	0.505
Adjusted R Square	0.496
Standard Error	0.079
Observations	59



ANOVA					
	df	SS	MS	F	Significance F
Regression	1	0.363	0.363	58.107	0.000
Residual	57	0.356	0.006		
Total	58	0.720			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	0.002	0.010	0.189	0.851	-0.019	0.023	-0.019	0.023
r DAX	1.409	0.185	7.623	0.000	1.039	1.779	1.039	1.779

Source: Own calculations

[2] Cost of Debt

Year	Description	Maturity Date	Amount Outstanding	Issued Amount	Coupon	Coupon Class	Issue Date	Last Price	Periods	Pmt Amount	Present Value	Future Value	YTM
2023	VOWGE / VOWG 0.875 16-Jan-2023 MTN	16-Jan-2023	1 000 000 000	1 000 000 000	0.875	Fixed Coupon	16-Jan-2015	99.866	1.06	8 750 000	(998 660 000)	1 000 000 000	1.00%
2023	VOWGCD / VOWG 3.250 29-Mar-2023	29-Mar-2023	346 509 407	346 509 407	3.25	Fixed Coupon	29-Mar-2018	99.538	1.26	11 261 556	(344 908 534)	346 509 407	3.65%
2023	VOWGF / VOWG 0.875 12-Apr-2023	12-Apr-2023	750 000 000	750 000 000	0.875	Fixed Coupon	12-Apr-2018	99.384	1.30	6 562 500	(745 380 000)	750 000 000	1.36%
2023	VOWGE / VOWG 0.750 15-Jun-2023	15-Jun-2023	750 000 000	750 000 000	0.75	Fixed Coupon	15-Dec-2017	98.89	1.48	5 625 000	(741 675 000)	750 000 000	1.52%
2023	VOWGE / VOWG 5.400 26-Sep-2023	26-Sep-2023	20 000 000	20 000 000	5.4	Fixed Coupon	26-Sep-2003	101.256	1.76	1 080 000	(20 251 200)	20 000 000	4.64%
2023	VOWGE / VOWG 1.125 02-Oct-2023	02-Oct-2023	1 500 000 000	1 500 000 000	1.125	Fixed Coupon	30-Mar-2017	98.462	1.78	16 875 000	(1 476 930 000)	1 500 000 000	2.01%
2023	VOWGF / VOWG 1.375 16-Oct-2023	16-Oct-2023	850 000 000	850 000 000	1.375	Fixed Coupon	16-Oct-2018	98.518	1.82	11 687 500	(837 403 000)	850 000 000	2.22%
...
2030	VOWGE / VOWG 4.375 15-May-2030	15-May-2030	750 000 000	750 000 000	4.375	Fixed Coupon	15-Nov-2022	98.217	8.49	32 812 500	(736 627 500)	750 000 000	4.65%
2030	VOWGE / VOWG 3.250 18-Nov-2030	18-Nov-2030	1 000 000 000	1 000 000 000	3.25	Fixed Coupon	16-Nov-2018	92.862	9.01	32 500 000	(923 620 000)	1 000 000 000	4.29%
2031	VOWGE / VOWG 4.125 17-Nov-2031	17-Nov-2031	512 812 412	512 812 412	4.125	Fixed Coupon	16-Nov-2018	87.788	10.02	21 153 512	(450 187 760)	512 812 412	5.76%
2032	VOWGE / VOWG 1.250 23-Sep-2032	23-Sep-2032	750 000 000	750 000 000	1.25	Fixed Coupon	23-Sep-2020	76.25	10.89	9 375 000	(571 875 000)	750 000 000	3.98%
2033	VOWGE / VOWG 3.300 22-Mar-2033 MTN	22-Mar-2033	850 000 000	850 000 000	3.3	Fixed Coupon	22-Mar-2013	90.926	11.39	28 050 000	(772 871 000)	850 000 000	4.33%
2033	HTRADN / HTRA 1.250 24-Mar-2033 '32	24-Mar-2033	750 000 000	750 000 000	1.25	Fixed Coupon	24-Mar-2021	71.359	11.39	9 375 000	(535 192 500)	750 000 000	4.52%
2034	VOWGE / VOWG 3.400 30-Jan-2034	30-Jan-2034	200 000 000	200 000 000	3.4	Fixed Coupon	30-Jan-2014	88.391	12.26	6 800 000	(176 782 000)	200 000 000	4.66%
2038	VOWGE / VOWG 4.125 16-Nov-2038	16-Nov-2038	1 250 000 000	1 250 000 000	4.125	Fixed Coupon	16-Nov-2018	93.444	17.12	51 562 500	(1 168 050 000)	1 250 000 000	4.69%
2039	VOWGE / VOWG 3.000 01-Jul-2039	01-Jul-2039	250 000 000	250 000 000	3.0	Fixed Coupon	01-Jul-2014	77.101	17.75	7 500 000	(192 752 500)	250 000 000	4.97%
2041	VOWGE / VOWG 1.500 21-Jan-2041	21-Jan-2041	300 000 000	300 000 000	1.5	Fixed Coupon	21-Jan-2021	62.923	19.34	4 500 000	(188 769 000)	300 000 000	4.38%
2043	VOWGE / VOWG 3.500 02-Apr-2043	02-Apr-2043	200 000 000	200 000 000	3.5	Fixed Coupon	02-Apr-2013	77.51	21.56	7 000 000	(155 020 000)	200 000 000	5.27%
												avg. YTM	4.31%

Source: Own calculations

Appendix F: Other Intrinsic Valuation methods

[1] DCF through Free Cash Flow to Equity

Free Cash Flow to Equity	2021	2022	2023	2024	2025	2026	2027
FCFF		2 893	5 857	6 366	7 344	10 777	10 471
(+) Increases in Noncurrent Financial Liabilities		--	--	--	--	--	--
(+) Increases in Current Financial Liabilities		--	--	--	--	--	--
(+) Increases in RCF Financial Liabilities		4 362	4 315	3 854	3 051	(4 258)	(5 067)
(+) Changes in Financial Liabilities		4 362	4 315	3 854	3 051	(4 258)	(5 067)
FCFE		7 255	10 172	10 219	10 395	6 519	5 404
Discounted Cash Flow							
Free Cash Flow to the Firm		7 255	10 172	10 219	10 395	6 519	5 404
Terminal Value							79 112
Discount Factor	1.00	0.92	0.84	0.77	0.70	0.64	0.59
PV 2022-2027		37 694 (45%)					
PV Terminal Value		46 600 (55%)					
Equity Value		84 294					

Source: Own calculations

[2] Dividend Discount Model

Dividend Discount Model	2021	2022	2023	2024	2025	2026	2027
Dividend (n-1)		3 772	3 782	3 600	4 022	4 426	4 391
Terminal Value							72 538
Discount Factor	1.00	0.92	0.84	0.77	0.70	0.64	0.59
PV 2022-2027		17 646 (29%)					
PV Terminal Value		42 727 (71%)					
Equity Value		60 373					

Source: Own calculations

Appendix G: Option Pricing Method (OPM) for equity allocation

[1] Option Pricing Method (OPM) explanation

The Option Pricing Method, OPM, is a tool for allocating the total equity value to individual ownership classes in a complex capital structure that relies on the Black-Scholes-Merton Model. This method treats the invested capital as a call option on a company's value. For enterprises with a simple capital structure (i.e., a single class of common equity), the OPM is not necessary and should not be used. However, when the subject business enterprise features multiple classes of preferred and/or common equity with differing economic rights, the OPM can be the most effective tool for differentiating the value of the various ownership classes (Harms, 2016 [19]).

The method is summarized in 4 steps:

- **1 - Determination of the Equity Value and Black-Scholes Assumptions:** In this model, the business value, or equity value, was derived through valuation techniques. For the Black-Scholes assumptions, the risk-free rate was the same used to calculate the cost of equity, the time to liquidity event was assumed to be a large number (since there is no plan for the company to a liquidity event), the volatility was computed as a weighted average of the annualized volatility of both types of shares and the spot price was assumed to be the equity value.
- **2 – Understand the Capital Structure:** Although Volkswagen AG's capital structure does not rely only on ordinary shares, its capital structure it is not so complex, having only preferred and ordinary shares.
- **3 – Set the Strike Price for the different classes of equity:** In general, classes of invested capital convert in a sequential manner through breakpoints. Conversion starts with the invested capital with the lowest price per common stock equivalent ("CSE"). Subsequent conversion of other invested capital will follow this pattern. Given the simple structure, there were identified only 3 breakpoints: preferred shareholders start receiving the value and then, as common stock price rise, common shareholders start receiving the value and the preferred shareholders are assumed to convert their shares to receive the same as the common shareholders.
- **4 – Allocating Value:** After having the strike prices and breakpoints, it is time to allocate the equity value.

[2] Option Pricing Method (OPM) application

Required Inputs: Please note that, in this application, the spot price will be same the result as the one performed by the DCF through FCFF.

Inputs			Black-Scholes Inputs	
Common Stock	shares	295 089 818	Spot Price	97 274
Preferred Stock	shares	206 205 445	Time to Maturity (years)	999
Total		501 295 263	Dividend yield	0.00%
Liquidation Preferences	per share	0.06	Risk-free Rate	2.56%
Total		12 372 327	Implied Volatility	39.07%

Source: Thomson Reuters, VW AG Annual Report 2021 and own calculations

Breakpoints: To compute the breakpoints, it is important to pay attention to the evolution of the share/strike price. For a share price of 0, there is the liquidation preference for preferred shareholders ($0.06 * 206205445$). As the share price starts growing, common shareholders start receiving some Value. Finally, as the share price reaches 0.06€, the company started to be able to pay some dividends to all the shareholders.

	Time 0	Preferred shall start receiving the value	Common Start receiving the value	Preferred convert
Liquidation Preferences				
Preferred Stock		12 372 327	12 372 327	--
Total Liq Value	--	12 372 327	12 372 327	--
No. Shares				
Common Stock			295 089 818	295 089 818
Preferred Stock				206 205 445
Total Shares	--	--	295 089 818	501 295 263
Equity Value				
Price/Strike Price			--	0.06
Value of Shares	--	--	--	30 077 716
Breakpoint	--	12 372 327	12 372 327	30 077 716

Source: Own calculations

Option Price: After having the breakpoints, it is now possible to start computing the value of the call option and compute the differential between each breakpoint, as can be seen in figure below.

Call Option Value					
Strike Price		0	12 372 327	12 372 327	30 077 716
Spot Price	97 273 627 832	97 273 627 832	97 273 627 832	97 273 627 832	97 273 627 832
Time to Maturity		999	999	999	999
Dividend Yield		0.00%	0.00%	0.00%	0.00%
Risk-free Rate		2.56%	2.56%	2.56%	2.56%
Implied Volatility		39.07%	39.07%	39.07%	39.07%
d1			734	734	662
d2			722	722	650
Call value	97 273 627 832	97 273 627 832	97 273 627 832	97 273 627 832	97 273 627 832
Diferential		0	0	0	97 273 627 832

Source: Own calculations

Allocation: To compute the allocation table, firstly it is important to allocate the values between liquidation preferences and shares. After having those values allocated, it is necessary to multiply each value for the call price to have the equity value allocated properly.

<u>Allocation table</u>	<u>Liquidation preference</u>	<u>Shares</u>	<u>Shares</u>	<u>Shares</u>
Preferred	12 372 327			206 205 445
Common		295 089 818	295 089 818	295 089 818
Total	12 372 327	295 089 818	295 089 818	501 295 263

<u>Allocation</u>				
Preferred	--	--	--	40 013 048 585
Common	--	--	--	57 260 579 247
Total	--	--	--	97 273 627 832

Source: Own calculations

Finally, to achieve the proper share price for each equity instruments, the total values should be divided by the number of outstanding shares. For this base scenario, the share prices for both instruments was:

<u>Share Price</u>	<u>Total</u>	<u>No. Shares</u>	<u>Price per share</u>
Preferred	40 013 048 585	206 205 445	194.04
Common	57 260 579 247	295 089 818	194.04

Source: Own calculations