A CRITICAL INVESTIGATION OF THE STANDARD DISCOUNTED CASH FLOW MODEL FOR HIGH-GROWTH COMPANIES

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A PRACTICAL ANALYSIS

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Abstract

Purpose - The purpose of this research paper is to analyse the ability of the standard discounted cash flow model to value high-growth companies. In particular, it tries to identify the challenges arising with the valuation of high-growth companies in a dynamic business environment and provides potential solutions on how to improve the standard discounted cash flow model to value high-growth companies more accurately. Special attention is directed towards the strategic as well as the technical aspects of the standard discounted cash flow model.

Design - The research method chosen to analyse the valuation of high-growth companies using the standard discounted cash flow model is a case study conducted with Tesla as a case company. The study is based on a broad range of secondary qualitative literature and quantitative data.

Findings - The study shows that the standard discounted cash flow model has to face several issues when valuing high-growth companies like Tesla. Problems arise in the strategic analysis and the technical valuation. Valuing a high-growth company such as Tesla using the standard discounted cash flow model is challenging since not only Tesla has a rapid speed of change but also the current economy developed further compared to the economy at the time the standard discounted cash flow model was developed. However, since the discounted cash flow model can be applied very dynamically and can be changed through various adaptations and extensions, it is nevertheless also possible to value very dynamic companies like Tesla. Thus, the model should be applied and adapted more flexibly to the characteristics of the analysed company.

Value - This study combines and extends the existing research by analysing each component of the discounted cash flow model by using the case company Tesla to identify challenges arising in a dynamic and fast-moving market environment. The study provides practical insights to solve these challenges and to receive a more accurate valuation of the company at hand.

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1. Introduction

"Price is what you pay, and value is what you get" is one of the most famous quotes from Warren Buffett. This statement is highly relevant for investors as their goal is to achieve an adequate return on their investment. In order to achieve the required return on their investment, it is crucial that the price they pay for it is not higher than its value. Thus, it is crucial for investors or analysts to carry out a valuation and determine the value of an investment before making an investment decision. Company valuations are mostly used in the context of mergers and acquisitions transactions, decisions on the purchase or sale of shares and the granting of loans (Petersen, Plenborg and Kinserdal, 2017). Generally, no valuation is easy and straightforward, as every company has their own unique characteristics. However, the valuation of young and high-growth companies is an especially difficult task. These companies are characterized by uncertain factors that complicate the valuation even further, such as short and volatile operating histories, uncertainty about future growth and changing risk profiles (Damodaran, 2018).

Furthermore, start-ups and high-growth companies obtained a more important role in the business environment over the last decade. They are nowadays often the key drivers of innovations and their products are influencing and transforming the world and the global economy massively. This development is supported by the increasing number of unicorns, of which there are 477 today (The Global Unicorn Club, 2020). Unicorns are companies which have a one billion plus valuation but are not publicly listed yet (De Massis, Frattini and Quillico, 2020). Their growing influence is reflected in the increasing number of new Unicorns per year, which grew from 61 in 2014 to 151 in 2018 (Gené Teare, 2019). All young and high-growth companies have high external capital needs, which are generally higher than the external capital needs of mature companies. These external funds are needed to successfully realise the ambitious future growth plans as a lack of financial resources is often the greatest hurdle for their business expansion (Damodaran, 2009; Borsa, 2016).

Every successful company started once as a start-up. Even though young and high-growth companies only constitute a small part of the economy, they have a high overall impact for several reasons. Firstly, young and high-growth companies are responsible for a big majority of the job creation (Acharya, 2019; Acs and Szerb, 2007). Secondly, young and high-growth companies have a great innovative influence on the economy. Clayton Christensen stated in the early 1990s that radical innovations are mainly created by young firms, since the established firms have too much to lose from the innovation. For instance, the current situation in the automotive industry confirms this argumentation. The radical transformation from a combustion engine to an electric motor has not been created by mature automotive companies like Volkswagen, Daimler or BMW. Instead, it arose through Tesla, an innovative high-growth company. Thirdly, the fastest-growing economies in the last few decades are the ones with the highest rate of new business formations. Thus, young and high-growth companies bear an enormous influence on the growth of gross domestic products. The growth of many small new technology companies in the United States during the 1990s consequently led to a much higher growth rate than in Western European countries (Damodaran, 2009).

The increased importance of young and high-growth companies is supported by the ongoing low-interest phase and the uncertainty in the financial markets, also for investors. Investors are seeking new investment opportunities due to decreasing returns on bank deposits, state or company bonds and other loan products. Therefore, shares, and especially the shares of high-growth companies are an attractive investment opportunity, as they are potentially offering higher returns (Kräussl, Lehnert and Rinne, 2017)

One of the most controversially discussed companies in the last years, which has entered the market successfully, is Tesla. Tesla succeeded to transform one of the most mature and competitive branches in the world, the automotive branch, introducing a shift to a more sustainable industry by producing vehicles with electrified engines. Thereby, the company successfully altered from a young start-up into a high-growth company. However, even today Tesla is moving into new business areas, where they are the pioneers of change and showing many similarities with a start-up. The further development of their energy storage and generation segment, an electrified truck and autonomous driving are some of Tesla’s future plans.

The question arises how the fair value of such a unique company should be determined. Even though no valuation is easy and straightforward and often varies among different analysts since in all cases it includes a prediction of future scenarios, the valuation of Tesla leads to even more discussions and problems. According to the “Dean of Valuation” Aswath Damodaran (2020), Tesla is a company with no middle ground among analysts. Optimists are of the opinion that the company is conquering the world, while pessimists call the company a ticking time bomb. According to a recently published video where Damodaran encourages people to value the company by themselves just by making their own assumptions regarding future revenues, future operating margin and risk, the company's intrinsic share price varies within a range of $105,79 and $2105,55 (Damodaran 2020). The question arises why there is such a wide range of estimations for the intrinsic value of the company, while the standard discounted cash flow model claims to be more or less easy and straightforward.

Nowadays, an increasing number of factors - like unique business models, mostly unpredictable market conditions and charismatic leaders - are potentially influencing the valuation of a company. How does the most widely used valuation model, the standard discounted cash flow model, take these factors into consideration? What potential conclusions can be drawn from the identified problems? Additionally, are there any other significant factors, which are generally not considered in this model?

2. Problem Statement

The purpose of this study is to identify the challenges linked with the valuation of high-growth companies using the standard Discounted Cash Flow model (in the remainder of this paper referred to as DCF model). Furthermore, it aims to present recommendations on how to modify the standard DCF model in order to capture the characteristics of high-growth companies more accurately. Thereby, this study uses Tesla as a case company.

The business focus of high-growth companies like Tesla differs from the business focus of mature companies like Coca-Cola. Especially in the beginning, having a high-growth rate and market share is much more important for high-growth companies than having a profitable business. This business model implies that these companies have a high level of external capital requirements in their first years in business. These capital requirements are either financed through various investment rounds or by taking on new debt. Thereby, it is in the interest of both investors and owners to determine the value of the company as accurately as possible. This is usually done with the help of the DCF model. This study questions whether the widely used DCF model can be applied for high-growth companies as well. The general idea behind the DCF model is in all cases the same, while there are several variations to discount the future cash flows. Since not every model uses the same assumptions, this study confines itself to the DCF model as described by Petersen et al. (2017), in particular to how it is presented in their book "Financial statement analysis". Thus, whenever this study refers to the standard DCF model, it refers to the DCF model of Petersen et al. (2017).

At its core, this study is not a company valuation, but rather aims to identify potential problems in the valuation process of high-growth companies and offers potential ideas to deal with these problems. The study can be of interest to any person that is interested in approaching a valuation using the DCF model from a different angle. This can be among others, investors, analysts, professors and students. In this light, the research question is defined as follows:

How can the standard discounted cash flow model be further improved to value high-growth companies like Tesla more accurately?

The research question will be examined through a comprehensive analysis of the different challenges within the different stages of the DCF valuation process. In order to get a profound knowledge that can serve as a solid basis for the valuation, the company is introduced. In addition, the different steps of the company life cycle are introduced and the different steps of the DCF model process are outlined: (1) Identification of strategic value driver; (2) Transformation of strategic value drivers into financial drivers; (3) Technical valuation. For each of these three steps one sub-question is defined:

(1) What are the challenges in identifying strategic value drivers and the future growth potential of high-growth companies like Tesla and how can they be dealt with?

(2) What are the challenges in quantifying the strategic value drivers into future cash flows and how can they be dealt with?

(3) What are the challenges when determining a discount factor for high-growth companies like Tesla and how can they be dealt with?

3. Methodology

After determining the relevance of this topic and introducing our research question in the previous part, this chapter is devoted to the research process and the applied methodology. This methodology section is structured in accordance with the research onion as described by Saunders et al. (2016). The research onion links the design decisions in terms of data collection techniques and data analysis procedures to previously defined assumptions regarding philosophies of science and approaches to theory development. The chapter is divided into four sections. In the first section the development of the research topic is described. In the second section the scientific anchoring of this study is elaborated, which describes the underlying philosophy and the approach to theory development. In the third section the research design of this study is explained, which is about the methodological choices regarding time horizon, research strategy and data collection and analysis methods. In the last section, the research integrity dealing with data quality and interpretation issues as well as potential limitations is discussed.

3.1. Development of the Research Topic

In this paragraph, the different stages of the development of our research topic and the refining of our research question are outlined. During their bachelor studies both researchers created a strong interest in the finance area, which was especially caused by different courses in the area of valuation and business analysis. This interest led to the choice of the master program "Accounting, Strategy and Control", which enabled them to acquire a deeper knowledge about accounting and valuation topics.

The program met the expectations of both researchers and further deepened their accounting and finance knowledge. The course "Financial Statement Analysis" was of particular interest and therefore the reason, why both researchers decided to write their thesis within this field. The failed IPO of The We Company caused a discussion about the valuation of companies between them. The high value of $47 billion at the beginning 2019 and the, by contrast, low valuation at the end of the year with $8 billion, evoked the question about the seeming simplicity of company valuation (Pietsch, 2020)

During their program, both researchers noticed a critical reflection regarding topics and the relevance of different point of views in the accounting area, whereas in the finance area many assumptions were taken for granted. Even though their financial knowledge was deepened during the course, they still pursued the desire to further strengthen the critical thinking and degree of reflection for the topic of valuations. Additionally, one of the researchers learned about the difference between a practical and theoretical company valuation during an internship in an investment bank. This resulted in the first draft of a topic for this thesis concerning " the problems and limitations with high-growth companies like The We Company before an IPO". Subsequently, the idea was further elaborated and the first table of content for this thesis was created. In the first part the We Company would be analysed and in the second part the limitations and problems within this analysis would be critically reviewed.

In the process of discussing the idea with their supervisor, the simultaneous valuation and critical examination of this valuation, was concluded to be too broad of a topic. Hence, the topic was narrowed down to solely the critical analysis of the valuation of high-growth companies, also it was the original idea of the thesis. Concerns emerged during the research process about the data availability of the We Company. Even though the We Company would have been an interesting case company, the lack of annual reports and data resulted in the decision to further progress with another case company. As a new case company Tesla was chosen. Although Tesla is much more established than the We Company, many attributes characterize it as a high-growth company. After this process, the final research question was created.

3.2. Research Philosophy

When researchers focus on a particular research area or topic, they try to contribute to the existing knowledge. Even if the results are not revolutionary, further knowledge about the underlying research topic will be developed (Saunders et al., 2016). According to Saunders et al. (2016) the research philosophy relates to the underlying assumptions and beliefs about knowledge development. Saunders et al. (2016) define five main research philosophies within the business and management research: positivism, critical realism, interpretivism, postmodernism and pragmatism.

The underlying theory adopted by Petersen et al. (2017) is the starting point of this study. Their theory has its outset in a positivistic view of the world. Positivism is related to the philosophical attitude of a natural scientist. This means working with an observable social reality that is similar to those in the physical and natural sciences. Positivism produces law-like generalizations and facts that are not influenced by human interpretation or bias. Petersen et al. (2017) claim that with a combination of the past financial and strategic value drivers the future can be forecasted and the technical framework of the DCF model does not have to be major adapted for different companies. Hence, according to Petersen et al. (2017) the analysis is unbiased and almost without interpretation (Saunders et al., 2016). Thus, Petersen et al. (2017) produce law-like generalizations about valuation.

However, this study challenges these law-like generalizations and theorizes that there is no single reality underlying the valuation. Consequently, in this study the interpretivism philosophy of science is applied. Interpretivism is a subjectivist philosophy, that is based on the assumptions that human beings are not similar to physical phenomena, as they create meanings. Empirically, interpretivists focus on individuals' lived experiences and cultural artefacts, and seek to include their participants' as well as their own interpretations into their research. Since business situations are complex, and often unique in terms of context, the interpretivist perspective is highly appropriate for business research. The interpretivism philosophy is highly applicable for this study as it is possible to question the underlying assumptions of a positivistic view on the world (Saunders et al., 2016). This is in accordance with the fact that the range of valuations differ, and the calculated intrinsic enterprise value can vary among analysts (Damodaran, 2020).

3.3. Theory Development

After the outline of the research philosophy in the last section, this section describes the development of the theory. The section begins with a short description of the various methods of theory development, followed by their application to this study. Saunders et al. (2016) define three common alternative approaches to the relationship between theory and reality: the deductive approach, the inductive approach, and the abductive approach. Deductive research tries to test existing theories by applying them in the real world. A theory and hypothesis are developed, and a research strategy is designed to test the hypothesis. Inductive research, on the other hand, is explorative and aims to generate theory. Data is collected, and a theory is developed as a result of the data analysis. The combination of deductive and inductive research, which alternates between data and theory, is referred to as abductive research (Suddaby, 2006). Abductive research is initiated by data to investigate a phenomenon. This is followed by the development of a plausible theory that explains the underlying cause.

This study builds on an ongoing interaction of theory and data, which indicates the inclusion of both deductive and inductive elements. First, the deductive approach has been applied by using a theory based on an existing model, the DCF model of Petersen et al. (2017). Within this framework, the valuation process has been divided into three main parts: (1) Identification of strategic value drivers; (2) Transformation of strategic value drivers into financial value drivers; (3) Technical valuation. Each part has been subdivided as detailed as possible in order to analyse the valuation process in its entire depth. The analysis has been carried out with the help of scientific literature, which has formed the basis for a discussion section. After concluding that the DCF model is not entirely suitable for valuing Tesla, the inductive approach has been applied by drawing conclusions from additional data sources that have been gathered to question certain factors of the DCF model. Based on the findings of the different steps of analysis, new possible solutions and improvements have been suggested to adapt the DCF model for Tesla and other high-growth companies.

3.4. Formulating the Research Design

After explaining the research philosophy and approach to theory development, this section discusses the underlying research design. The research design addresses the methodological selection, the strategy, and the time horizon of the underlying study. The research design plays an important role in answering the research question and is briefly outlined and discussed in the following paragraphs.

In order to answer the research question correctly and to develop proposals on how the standard DCF model should be modified to evaluate Tesla, the underlying research approach is an individual case study. According to the literature, a contemporary phenomenon is examined in detail and in its real context in a case study (Yin, 2018). A single-case case study approach is appropriate for this study, as it focuses the analysis on one specific case company. This allows for a more detailed and accurate analysis of the given problem. Thus, the chosen research strategy enables an in-depth discussion of Tesla's specific problems with the standard DCF model. In addition, Yin (2018) distinguishes between five reasons why a single-case study approach is an appropriate method: critical, unusual, frequent, informative or longitudinal. The critical case is most applicable to this study. The critical case implies that a single case study is used to "determine whether some statements are correct or whether an alternative set of statements might be more relevant" (Yin, 2018). In this way, it can contribute to theory either by extending, questioning, or confirming it. The aim of this study is to question the standard DCF model using Tesla as an example and to develop possible ideas for improving the model. In doing this, the study is intended to contribute to knowledge about the valuation of high-growth companies and can be described as a critical single case study within the definition of Yin (2018).

This research concerns a particular phenomenon at a particular point in time, which indicates that it is a cross-sectional study. Generally speaking, all the data that has been used in this study corresponds to a single point in time. However, since the development of Tesla in recent years and the possible future development of the company as well as external studies describing the development of the market environment are considered, some longitudinal elements are also included in the study (Saunders et al., 2016).

Additionally, one must distinguish between the research methods of qualitative and quantitative research. The main difference is the use of numerical data (Silverman, 2010). The use of quantitative data is primarily a matter of statistical analysis using quantification of data collection. The quantitative research method is usually applicable to large samples and leads to rather generalizable results (Silverman, 2010; Patton, 2015). In contrast, qualitative methods are used to obtain research results that are not derived with a quantitative method (Strauss and Corbin, 1990). Qualitative methods focus more on a deeper understanding of words and experiences than on numbers. It is therefore a matter of exploring and understanding a particular context (Bryman, 2016). In this study, one main factor is to identify, analyse and develop solutions for the qualitative elements behind the individual quantitative components of the DCF model. That is why qualitative research goes hand in hand with the interpretivist approach and the case study strategy. According to Saunders et al. (2016), corporate and management research often uses a research design that makes use of both quantitative and qualitative data. However, the research question finally determines the choice of research method.

This study incorporates quantitative as well as qualitative data. To illustrate, quantitative data is used in the form of financial data coming from annual reports of Tesla and its competitors. Qualitative data is used by analysing different papers and studies dealing with the DCF model, Tesla as a company as well as the changing environment around the case company. All in all, the study is mostly conducted on a qualitative level and not on a quantitative level, since the focus lies on gaining a better understanding of the DCF model.

Babbie (2007) identifies three purposes of social-science research: exploratory, descriptive, and explanatory. ”Exploratory research is research conducted concerning a that has not been studied more clearly, is intended to establish priorities, develop operational definitions and improve the final research design. Exploratory research helps determine the best research design, data-collection method and selection of subjects. It should draw definitive conclusions only with extreme caution” (Shield and Rangarajan, 2013, p. 47). Since the purpose of this study is to analyse the question “How can the standard DCF model be further improved to value high-growth companies like Tesla more accurately?”, it can be classified as an exploratory study. Exploratory research sheds light on the current situation and provides insight into a specific topic. Even though the study is explanatory in a way that it explains the problems with the standard DCF model for high-growth companies like Tesla, the main purpose of this study is to further improve the existing model. Hence, the study is closest to being of an exploratory nature.

In summary, this section has examined the methodological choice (qualitative and quantitative), the research strategy (single case study) and the time horizon (cross-sectional study) and how these elements contribute to the coherence of this study by aligning them with the underlying research philosophy and approach to theory development.

3.5. Data Collection

Generally, data can be divided into two types: primary and secondary data. Primary data is collected exclusively for the purposes of the underlying study by using for example interviews or observations. Secondary data already exist in the research field, such as literature or scientific journals (O’Gorman and MacIntosh, 2014). This type of data has been generated for the purpose of another study but can be reused for other studies. Because the collection of secondary data is less time consuming, more of it could be added to a study as compared to a study using only primary data (Vartanian, 2011).

For this study, only secondary data is used. Secondary data provide further information about the case company and its competitors as well as the various approaches to company valuation in particular the DCF valuation (Saunders et al., 2016). The entire valuation process is divided into the three steps as described in section X. By subdividing the valuation process, it was possible for each of the three steps to initiate the discussion by presenting a detailed literature review, to discuss the results of the review and to bring our existing knowledge based on work and university experience to the table.

In each of the three steps, the analysis is conducted following a two-step(s) model. The first step comprises an analysis of which kind of problems occur if the DCF model of Petersen et al. (2017) is applied to Tesla. To identify and analyse the occurring problems, critical literature reviews, databases and conducted in-depth discussions using the researchers' previous professional and academical experience are used. There exists a large amount of literature on strategic business analysis and company valuation. In addition, data platforms, many scientific papers and newspaper articles are used for the analysis. A part of the secondary data of these companies is collected in the Thomson One database. For consistency reasons, the aim was to collect all market data of the publicly listed peers from one database, as it is assumed that they were estimated in the same way.

In the second step, the same procedure is applied while discussing potential new ideas for the identified problems. The same critical literature review is conducted in combination with previously gained knowledge from work experience and studies to discuss and develop the potential solutions to improve the DCF model of Petersen et al. (2017) for Tesla. In line with the chosen interpretivist philosophy of science, the researchers include their own interpretations of studies and academic literature and propose new solutions based on them.

It should be noted that secondary data is subject to distortion or poor quality (Saunders et al., 2016). To ensure the relevance, validity and reliability of the secondary data for this thesis, the three-step model of Saunders et al. (2016) is used. This three-step model allows for a critical evaluation of the data to ensure the relevance of the literature and encompasses the following steps:

1. general suitability of the data for research questions and objectives

2. the exact suitability of the data for the analysis

3. assessment of costs and benefits

In the first step, it is ensured that the data corresponds to the research objective of this work. A thorough review of the secondary data and an assessment of whether the setting and timing of the data is consistent with the underlying circumstances of the research objective ensures that the data can be applied to this study. The second step concerns the validity and reliability of the data. The sources of the secondary data are critically evaluated. The third step is to assess whether the benefits of secondary data exceed the costs of collecting them.

3.6. Limitations

A piece of scientific work can only present a limited view to a research area. Therefore, some limitations must be recognised in order to focus the study and examine the concrete problem statement. In this section, both theoretical and practical limitations are discussed. Since the thesis is written based on the interpretivism philosophy, the concepts of "transferability", "dependability" and "credibility" proposed by Lincoln & Guba (1985) for qualitative research are used to demonstrate the limitations of this work.

Transferability

The transferability of the study is ensured by presenting a complete overview of the research design, the research questions, the context as well as the results and interpretations. This should make it possible to determine whether the study is transferable to another context (Lincoln & Guba, 1985). Particularly in the context of qualitative studies, transferability is often not given, since qualitative data, unlike quantitative data, often do not allow for statistical generalisation. However, this is also not the purpose of qualitative research, as it is designed to provide insights into specific situations rather than statistical generalisation (Saunders et al., 2016). Qualitative studies are often pursuing analytical generalization, where the investigator tries to generalize the results into a more comprehensive theory (Yin, 2003). This study deals with the analysis of the standard DCF model in the context of the valuation of high-growth companies while using Tesla as an example. The results of this study can be tested for analytical generalization by replicating the study to other companies to see if similar results are obtained for them.

In order to create as much transparency as possible throughout this thesis, a detailed description of the case company, the basic theory underlying the analysis, and a detailed discussion of the methodological implementation are described. This transparency facilitates the possibility to transfer this case study to other companies. Especially within the framework of the theory, there is a high transferability potential, since it is completely based on the model described in the book "Financial Statement Analysis" by Petersen et al. (2017). In contrast, the identification of problems and the development of improvements is based on an intensive literature research in combination with knowledge gained through practical experiences, which the researchers have used to identify these problems and develop solutions in didactic discussions. Thus, there is a considerable chance that other researchers would identify other problems and create other potential improvements. Furthermore, one should be aware that this research embodies a cross-sectional study in which, due to the Corona situation and the closure of the university, only data until the 31st of December 2019 have been considered and in some exceptions until the 31st of March 2020. Tesla’s market environment as well as Tesla itself as a company may have been altered and thus, the basic input assumptions regarding the market environment and Tesla could have changed. Additionally, as the researchers use the interpretivism approach with assumptions regarding Tesla, its main products, and competitors, other researchers could potentially make other assumptions regarding these factors, which would strongly influence the outcome of this work.

Dependability

In the context of interpretative research, it is likely that the research will be modified. Dependability means that thought processes that have emerged during the process of creating the work are recorded to ensure that a third party can follow it up conclusively (Lincoln & Guba, 1985). In the course of the underlying study, new findings have certainly emerged at various points in time. At these moments, a discussion was held to review the situation in the light of the new findings and to decide whether or not the current direction of research should be adapted. A detailed description of the evolvement of the research framework has been presented in the previous section in the description of the origin of the research question. Furthermore, the section on the research question provides an overview of the research intentions of this study. Although the aim of this study is to present and document the researcher's train of thought in the best possible way, it is not possible to describe the complete train of thought to the reader, especially the thought process behind the analysis part of this study, which is a process of iterative thought. This is supported by Saunders et al. (2016). The advantage of qualitative research lies precisely in its flexibility, especially in the context of the researcher's thought processes. As described in the methodological choice section, an extensive amount of literature was read whereby the two researchers could also have been influenced unconsciously. It is therefore not feasible or realistic to fully document the researcher's train of thought without reducing the strength of interpretative research.

Credibility

Credibility emphasizes that the representations of what is shown in the research are in accordance with the intentions of the participants. There are various ways to ensure credibility, e.g. through discussion, critical reflection of ideas and results, thorough analysis, and the inclusion of studies and papers from different perspectives in order to achieve an in-depth view of the research objective under investigation (Saunders et al., 2016). First of all, since the research has been conducted by two researchers, it should be mentioned that there was always a discussion between them, and that the ideas and results were critically reflected upon. However, since both have been working on the same study, there may be a lack of external viewpoints, which could limit this effect. The second point relates to the inclusion of different studies and papers, as a wide range of literature and data has been considered. Nevertheless, it is never possible to include the full range of literature and views on a topic. However, since a large amount of literature and data has been used, the researchers believe that the amount is sufficient to support the credibility of this study.

4. Literature Review

The literature review starts with explaining the distinction between intrinsic value and market value followed by an in-depth introduction into the DCF model. At the end of the literature review, the different stages of the company's business life cycle are introduced.

4.1. Intrinsic Value vs Market Value

"Every asset has an intrinsic value", Damodaran (2018) states as one of the first sentences in his book "The Dark Side of Valuation". The literature distinguishes between the intrinsic value of an asset and the market value of an asset, since the two values are based on different concepts. Lee, Myers and Swaminathan (1999) define the intrinsic value as follows: "A stock's intrinsic value is the present value of its expected future dividends (or cash flows) to common shareholders, based on currently available information" (Lee, Myers and Swaminathan 1999, p. 1). Other authors confirm this definition by defining the intrinsic value of an asset as the present value of the expected future cash flows over its lifetime, discounted by a factor reflecting the time value of money and the riskiness of the cash flows (Damodaran, 2018; Koller, et al., 2010; Petersen et al., 2017). The market value is defined as "the sum of the common stock, the preferred stock, the long-term debt adjusted for the inflation and the short-term debt net of assets" (Hall, Jaffe and Trajtenberg, 2005, p. 6). Theoretically, the intrinsic value and the market value should be identical, however, short-term differences between the intrinsic value of an asset and its market value can occur due to irrational market behaviour (Koller et al., 2010). These short-term irrational behaviours could be observed during the dot-com bubble and its burst between 1996 and 2004 as well as in the leveraging and credit crises between 2004 and 2009 (Koller et al., 2010). According to the efficient market hypothesis, the market price of an asset returns to its intrinsic value over time (Brealey, et al., 2017). Hence, this study focuses on the determination of the intrinsic enterprise value excluding the influence of short-term irrational behaviour.

4.2. Introduction into Valuation

The valuation process is divided into three steps. Firstly, in a strategic analysis of the company actual and future strategic value drivers are identified. Secondly, the strategic value drivers are combined with the historical observations to prepare future pro forma statements. Lastly, the calculated free cash flows from the pro forma statements are discounted by a discount factor combining the time value of money and the investment risk to calculate the intrinsic enterprise value (Petersen et al., 2016).

However, as a prerequisite for the valuation, the company's historical financials are reformulated for analytical purposes. Thereby, operating and financial activities are differentiated to analyse the operating activities in terms of profitability and growth (Petersen et al., 2017). In order to understand and analyse the company's business model and activities, the analyst must reformulate financial statements into analytical financial statements. Since the value creation inside a company is mainly driven by its operating activities, it is important to distinguish between operating and financial activities. Thus, of special importance are the analytical income statement and the analytical balance sheet for identifying the core business of the company. The operating business is the key driver for future earnings, as the financial structure of a company can be easily duplicated. Based on the analytical income statement historical profitability and trends are determined. Furthermore, it is possible to analyse the cost structure within the core business and identify the development of cost of goods sold; selling, general and administrative expenses; and research and development costs. Through the analytical balance sheet, the invested capital and the net interest-bearing liabilities (NIBL) of the company are calculated. Especially the NIBL are of great importance for the DCF valuation as they are used as an approximation for the market value of debt used in the weighted average cost of capital (Petersen et al., 2017), which will be discussed further on in the literature review.

4.2.1. Strategic Value Driver Analysis

The economic success of a company is largely based on its ability to predict future market trends. Even if the future cannot be predicted with certainty, the identification and analysis of potential future trends are the foundation of value creation inside a company. More specifically, the future trends determine the company's external business environment. Besides external factors, there are also internal company specific factors like the production activities, the potential of outsourcing and the back-office activities that need to be taken into account in strategic analyses (Petersen et al., 2017). The business environment is commonly analysed with the PESTLE analysis and Porter's five forces analysis. Whereas the PESTLE analysis deals with the macro-environment, Porter's five forces analysis covers the industry landscape. The processes within the company are analysed with the value chain analysis and the adapted value chain analysis (Petersen et al., 2017).

4.2.1.1. PESTLE Analysis

The PESTLE analysis is a strategic planning tool used for identifying external influences on a company. The analytical tool is used to detect potential impacts and risks of political, economic, social, technological, legal, and environmental factors on a company (Rastogi and Trivedi, 2016).

The political factors consider the influence of governments on the company. Potential political factors are for instance tax policies or governmental stability. The economic factors determine the impact of the entire economy on the company. Examples of these are economic business cycles or inflation rates. The sociological factors take the characteristics of society and human behaviour into account. These are for example the distribution of income or social opinions on certain issues. The technological factors are related to technological innovations that may affect the future operations of the company. Potential technological factors are for instance new or further developments of technologies. Legal factors deal with the current and future framework of the business environment. Examples of factors are safety standards and import and/or export regulations. The environmental factors determine the influence of the environmental surroundings on the company. Environmental factors are for instance climate change or environmental legislation (Rastogi and Trivedi, 2016). The following table lists potential macro-wide factors analysed more precisely during a PESTLE analysis. However, the list of macro factors is not exhaustive as each company is affected differently due to its unique characteristics (Petersen et al., 2017).

4.2.1.2. Porter's Five Forces Analysis

“The attractiveness of an industry is ultimately a result of the possibility of earning acceptable returns” (Petersen et al. 2017, p. 271). To evaluate the attractiveness of an industry Porter's five forces analysis is frequently used. The attractiveness of an industry is driven by the level of competition within the industry. Therefore, Porter used five factors to determine this attractiveness. Figure 1 summarises the idea of Porter's five forces and highlights the different forces affecting the competition in a market or industry and thus, the possibility of earning attractive returns (Petersen et al., 2017).

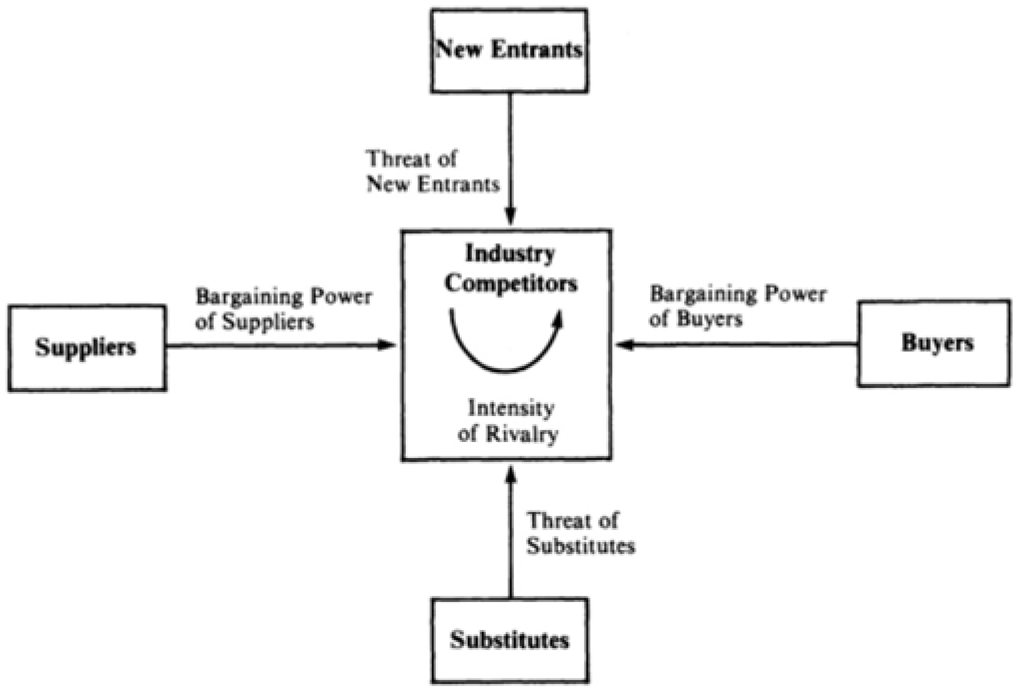

Figure 1: The five competitive forces that determine industry profitability
Source: Porter, 1998

The first of the five forces is the potential entry of new competitors in an industry. Through the entry of new competitors into the market, the entire market will be redistributed between all competitors. Hence, the companies already established in the market lose part of their market share which will ultimately affect returns negatively. Examples of potential factors impacting the threat of new market entrants are economies of scale, capital requirements and access to distribution channels (Porter, 1998).

The second of the five forces is the rivalry between existing competitors inside an industry. An increased level of competition affects the company's returns negatively. More competition inside an industry leads to more aggressive price wars that cut off profit margins. Examples of factors impacting the rivalry between existing market participants are industry growth, number of competitors and customer demands (Porter, 1998).

The third of the five forces is the potential pressure from substituting products. Substitutes limit the company's potential return due to increased competition. The more substitutes for a specific product are available, the lower is the potential profit margin. The number of substitutes is largely impacted by the price-performance relationship between products and their substitutes (Porter, 1998).

The fourth force of Porter's five forces is the bargaining power of buyers. It analyses the relative strength of the buyers inside an industry. High bargaining power of buyers is leading to lower margins within the industry. The bargaining power of buyers is for instance influenced by the concentration of buyers inside an industry or the possibility for buyers to switch suppliers quickly and cheaply (Porter, 1998).

The fifth and last force of Porter's five forces is the bargaining power of suppliers. The higher the relative bargaining strength of a supplier, the lower the profit margins inside the industry as the supplier can lower the profitability inside the industry through higher prices or lower product quality. Examples of factors impacting the bargaining power of suppliers are the concentration of the industry in relation to the concentration of the supplier industry or the relevance of the delivered product for the industry (Porter, 1998).

4.2.1.3. Value Chain Analysis and Adapted Value Chain Analysis

The previously introduced analyses focused on economic and market related influences and provided the analyst with information on the market size, the market growth and the possibility of earning attractive return in the industry. Additionally, an in-depth analysis of the company and its specific characteristics is of great importance. Internal analyses take these characteristics into consideration. The preferred tool for an internal company analysis is the value chain analysis.

Michael Porter, the founder of the Value Chain Analysis, describes a company “as a collection of activities that are performed to design, produce, market deliver and support its product. All these activities can be represented using a value chain.” The value chain analysis describes the activities within a company and relates them to peer companies to detect competitive advantages (Porter, 1985). Figure 2 show the factors of a value chain analysis.

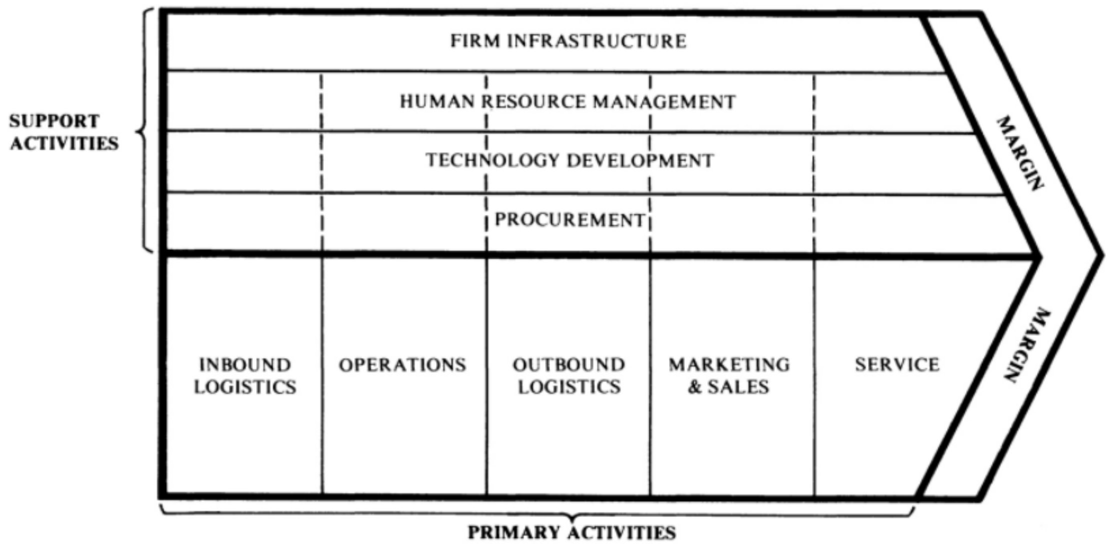

Figure 2: The Generic Value Chain
Source: Porter, 1998

Porter (1998) divides activities into primary activities and support activities. The primary activities are activities directly involved in the producing, delivering and after sales assistance of the products. Primary activities are grouped into five main areas: inbound logistics, operations, outbound logistics, marketing and sales, and services. In addition, the primary activities can be subdivided based on industry and company specific characteristics. Support activities are mainly responsible to ensure a smooth operation of primary activities. The main support activities are procurement, technology development, human resource management, and infrastructure. The support activities can vary between companies due to different organisational structures. Even if the primary activities add the value to the production process directly, both activities are relevant for the indication of competitive advantages against competitors (Porter, 1985). In the following paragraphs the primary activities and support activities are described.

Inbound logistics are related to the receiving, handling and warehousing of preliminary products such as inventory control, vehicle scheduling and return to suppliers. Operating activities are related to the conversion of raw materials into the final product, such as machining, packaging assembly, equipment maintenance, testing, printing and plant operation. Outbound logistics consist of activities related to collection, storage and physical distribution to buyers. These activities can include transporting finished goods to warehouses, material handling, operating delivery vehicles, order processing and scheduling. Marketing and sales activities are related to providing and encouraging buyers to purchase the product. This is done through advertising, sales promotion, sales personnel, quotations, channel selection, channel relationships and pricing. Service activities are the last activity group in the value chain of a company. These are activities associated with the provision of service to enhance or maintain product value such as installation, repairing, training, parts supply and product adjustment (Porter, 1985).

Procurement refers to the part of the value chain that deals with the purchase of inputs for the company. A distinction can be made between inputs for primary activities or support activities. Inputs for primary activities are for example raw materials or machines. For the support activities this is for instance the office equipment. Technology development is of great importance as it is used in all primary activities, whether it is new technology for purchasing, production or distribution. Not only primary activities benefit from new technologies, also support activities such as human resources benefit. Human resources management is associated with the recruitment, training, development and remuneration of all types of staff. Primary and support activities are dependent on the human resource management. Lastly, the company's infrastructure covers everything from general administration, planning, finance and accounting to legal, government and quality management. This support relates to the entire value chain and the entire company, not just to a single activity (Porter, 1985).

The adapted value chain is a modified tool based on the value chain analysis and extends the value chain through an additional quantified dimension. Thereby, the cost efficiency of the target company is compared to its peers. According to Petersen (2017) the operating expenses are divided into five cost categories. These are production, selling and distribution, administration, research and development and depreciation. For each category, the costs are calculated as a percentage of sales to make the numbers comparable between companies of different sizes. The comparison between the target and its peer companies identifies those parts of the value chain where there is a cost advantage over the peer group. This enables the identification of an overall competitive advantage as well as competitive advantages in individual cost categories.

4.2.2. Transformation of Strategic Value Driver into Pro Forma Statements

The pro forma statements lay the foundation for the company valuation. The DCF model is based on future cash flows derived from the pro forma statements. To prepare pro forma statements the past financials and the strategic value drivers have to be combined and transformed into financial value drivers. The free cash flow used within the DCF model is calculated from the income statement and the balance sheet. The key financial indicators for the free cash flow to the firm are net operating profit after taxes (NOPAT), capital expenditures (CapEx) and investments into working capital (WcInv). Thereby, the NOPAT is based on the income statement and the CapEx and WcInv are based on the balance sheet.

*NOPAT = Operating Income * (1-Tax Rate)*

CapEx = Net increase in PP&E + Depreciation and Amortisation

Working capital = Current Assets – Current Liabilities

According to Petersen et al. (2017) the sales-based approach is the preferred tool to prepare pro forma statements. As the sales is the top line-item while developing pro forma statements, they are most important for two reasons. Firstly, the sales are the key indicator for future growth. Secondly, all other line items are connected to the sales of the company because they are calculated as a percentage of sales.

Sales

The sales are forecasted based on a combination of historical sales figures and the future strategic value drivers. According to Petersen et al. (2017) "the historical period is used as a foundation for our forecast[...]" (Petersen et al., 2017, p. 256). Through the historical analysis, where absolute sales figures and historical developments and trends are indicated, the analysts receive insights into the average sales level and maximum and minimum value of the sales growth. However, just using historical financials would lead to wrong results, because even if "the history has a tendency to repeat itself" (Petersen et al., 2017, p. 268), just prolonging current trends in the sales would not capture potential changes in the future market environment. Thus, strategic value drivers must be included in the future sales forecast to see if current and historical trends will either continue or if not, the sales figures will be affected positively or negatively by the future strategic value driver.

Operating Expenses

As the sales-based approach is used in this study, the operating expenses are calculated as a percentage of the overall sales. Key items of the operating expenses are COGS and SG&A. The starting point is the historical development of the operating expenses as a percentage of total sales in order to determine a historical absolute level and to indicate past trends. Basically, one can assume that the historic relative level is a profound indicator for the future operating expenses. If the company's operating expenses as a percentage of sales are showing an increasing or decreasing trend, the probability that this trend might continue should also be taken into consideration. Additionally, the percentage of operating expenses in relation to that of its peers should be observed to verify if the operating expenses rate is reasonable and to analyse where potential differences originate from. Combining the historical and peer analysis with the strategic value drivers gives the analyst a foundation for the future operating expenses estimation (Petersen et al., 2017).

Non-current assets and working capital

As it is stated in the previous paragraph, in the calculation of the free cash flow to firm only CapEx and WCInv are relevant items. These are derived from non-current assets and the items of the working capital from the balance sheet. Thus, this study only refers to the prediction of these relevant items.

Based on the sales-based approach, the non-current assets and the working capital items are also calculated as a percentage of sales. The same procedure is conducted as the one for the operating expenses. In the first step, historical levels and trends within non-current assets and working capital items are analysed followed by a peer group analysis and strategic value driver analysis. Combining the historical and peer analysis with the strategic value drivers gives the analyst a foundation for the non-current asset and working capital estimation (Petersen et al., 2017).

Net interest-bearing liabilities (NIBL)

In the sales-based approach, the NIBL are calculated as a percentage of the invested capital. The invested capital is a measure directly related to the analytical balance sheet. Petersen et al. (2017) define invested capital as “the amount a firm has invested in its operational activities and which requires a return” (Petersen et al., 2017, p. 114). The invested capital is calculated as the sum of the operating non-current and current assets subtracted by the operating liabilities. As stated in the beginning of this paragraph, NIBL are calculated as the share of invested capital. In doing so, the historical share and trends of the NIBL as a percentage of the invested capital are analysed. Based on these historic observations, the share of the NIBL in the invested capital can be predicted.

4.2.3. The Discounted Cash Flow Model

The previous section described the entire process of forecasting future financial statements. Since this study deals with the DCF model valuation, the free cash flows are the foundation of the valuation model. The three technical factors of the DCF model (cash flow level, time horizon and discount rate) are discussed in the following paragraphs.

4.2.3.1. Cash Flow Level

Two alternative levels of cash flows exist in the DCF model valuation. The first alternative is the free cash flow to the firm, also called the company-based approach. It combines the cash flow to creditors and equity holders. The second approach is the equity-based approach. This approach takes the free cash flow to equity into account, which is only the cash flow to equity holders. In practice the standard and most well-known approach is the free cash flow to the firm (Petersen et al., 2017).

Free cash flow = NOPAT – CapEx - WCInv

4.2.3.2. Time Horizon

The literature assumes an infinite life cycle of companies (Petersen et al., 2017; Koller et al., 2010). To include this assumption, the DCF model is divided into two time periods. The first period, called the forecast period, captures the value of all cash flows until the company reached a steady growth rate similar to the growth rate of the overall economy. The second period, called the terminal period, combines all cash flows beyond that point in time until infinity. Depending on the input factors, the terminal value accounts for approximately 60% up to 80% of the intrinsic enterprise value (Petersen et al., 2017).

Forecast Period

The first period of the DCF approach is the forecast period. For all years during the forecast period pro forma statements are prepared. Thereby, company and market specific impact factors of the future are considered, and every year is forecasted independently without a direct relationship to the previous one. Thus, the cash flow can vary widely between the different years (Petersen et al., 2017). The general accepted idea regarding the length of the forecast period is, that it has to be long enough until the company's growth rate achieves a steady level. The steady level is defined as a growth rate similar to the growth rate of the overall economy (Damodaran, 2018; Koller et al., 2010; Petersen et al., 2017). Petersen et al. (2017) assume a three to six years period until this state is reached.

Terminal Value

As it is not possible to forecast until infinity the model includes a terminal value for that period. The terminal value, also called continuing value, sums up the value of all cash flows after the forecasting period. It should indicate the value of the company at the beginning of the terminal year. As previously stated, the terminal value accounts for a large part of the intrinsic enterprise value, hence it is important to pay careful attention to the estimation of the parameters driving the terminal value (Petersen et al., 2017). The most common model for calculating the terminal value is the growth model. According to Petersen et al. (2017) companies are not growing with a constant rate to infinity, but they will fluctuate around a long-term mean, which is used as the annual growth rate for infinity. The growth model consists of the terminal year cash flow, the discount factor and the infinity growth rate. As the terminal value accounts for approx. 60% to 80% of the overall enterprise value, the three factors have to be calculated with careful attention (Petersen et al., 2017).

4.2.3.3. Discount Rate – WACC

The discount rate should capture the time value of money and the projected level of risk of an investment (Brealey et al., 2017). It is the opportunity cost of capital of the investment in a specific project. The equity and debt holders of a company are risk averse and expect an adequate compensation for the cost of an investment today and for bearing the projected risk of the investment over its entire lifetime (Brealey et al., 2017; Petersen et al., 2017). As a company rarely consists of one project or investment, the discount factor used for valuing the entire company has to capture all expected returns of all the company's assets. Hence, the company's cost of capital determines the expected return on a portfolio of all the company's outstanding equity and debt (Brealey et al., 2017).

WACC

The weighted average cost of capital (WACC) is the expected return on a portfolio of all the company's outstanding equity and debt. It is the adequate discount factor for a company's average risk project and therefore the opportunity cost of capital for investments in all of the company's assets (Brealey et al., 2017). For a company which is only financed with pure equity and pure debt (no preferred stocks or convertible bonds), the WACC formula is impacted by five different variables: (1) the market value of equity (2) the market value of debt (3) the required return on equity (4) the required return on debt (5) the company's marginal tax rate. The following formula shows how these variables relate to the WACC:

*WACC = Return on Equity * (Market value of Equity / Enterprise Value) + Return on Debt * (Market value of Debt / Enterprise Value) * (1- tax rate) =* $r_e * ((E/(E+D)) + r_d * ((D/(E+D)) * (1-t)$

It should be considered that the formula can be expanded if the company is also financed with preferred stocks or convertible bonds (Petersen et al., 2017). However, this study focusses on the general formula, as it is the most relevant one. In the following part all components of the WACC formula are introduced. Each component is described in detail, as they are all impacting the WACC and consequently the company valuation.

4.2.3.3.1. Capital Structure

The capital structure is the combination of equity and debt used to finance a company's entire operations. It is important to use market values and not book values, as only market values reflect the true opportunity costs of investors and lenders. Petersen et al. (2017) introduce two approaches to calculate the capital structure, whereby the three authors base their approaches on private companies. Firstly, the capital structure of comparable companies which are traded on stock exchanges can be used. It is important to ensure that the companies are highly comparable. Since a sufficient number of listed companies is often not available in every country, the peer group can be extended with listed companies from other countries. However, institutional differences that influence the capital structure should be take into consideration (Petersen et al., 2017) Secondly, the capital structure can be calculated by using an iteration procedure. This approach requires a comprehensive forecast. Based on the forecasts, iterations are carried out until the composition of the capital structure within the WACC converge to the capital structure between market value of equity and market value of debt as the outcome of the valuation process. Petersen et al. (2017) suggest the application of both methods since potential measurement errors can be reduced.

4.2.3.3.2. Return on Equity

The required return on equity should compensate an investor for bearing risks. Thereby, the return on equity should be high enough to compensate the investor for taking the risk of investing into that company (Petersen et al., 2017). According to Petersen et al. (2017) the Capital Asset Pricing Model (CAPM) is the most used models for estimating the required return for investors.

*Required return on Equity = risk-free rate + beta of the investment * market risk premium*

The CAPM, first mentioned by Sharp in 1964, is based on the modern portfolio theory developed by Harry Markowitz (1952), using the concept that the standard deviation of a portfolio can be reduced by portfolio diversification with stocks which are not perfectly correlated (Bearley et al., 2017). The overall risk of an investment consists of systematic risk, called market risk and unsystematic risk, called company specific risk. The underlying idea behind the CAPM model is "that by holding a sufficiently broad portfolio of shares, investors will only pay for the risk that cannot be diversified" (Petersen et al., 2017, p. 345). Consequently, the investor only captures the risk portion in an investment which can be related to the market and overall economy, and hence cannot be diversified away. This risk, also called systematic risk, is the only risk priced (Brealey et al., 2017; Petersen et al., 2017).

The formula for the CAPM model, previously stated, consists of three variables: the risk-free rate, the systematic risk on equity (levered beta) and the expected return on the market portfolio. The systematic risk on equity is the only factor within the CAPM formula that is company specific and can vary for each company (Petersen et al., 2017).

Risk-free interest rate

The risk-free rate indicates the return an investor can expect for an investment without taking any risks. In the area of finance, risk is defined as the variance around the expected return of the investment (Damodaran, 2018). When the expected return of an investment always equals the actual return of an investment, this investment is risk-free. To fulfil this requirement, the investment should not have a default and reinvestment risk (Damodaran, 2018).

Theoretically, the best approximator to calculate the risk-free rate is building a zero-ß portfolio. A zero-ß portfolio is not impacted by the market and consequently risk-free. Since the composition of such a portfolio is costly and entails problems, generally government bonds are used as a proxy for the risk-free rate (Damodaran, 2018; Petersen et al., 2017). However, historical observations showed that also governments can go bankrupt, therefore this method should be used carefully and only government bonds of states with high financial ratings should be used. To overcome the problem of reinvestment, the government bond should have the same duration as the forecasted DCF. As this procedure makes the valuation unnecessarily complicated the literature agreed that 10-years, 30-years or even 50-years zero-coupon government bonds are the most effective choice (Petersen et al., 2017). Additionally, the government bond should be denominated in the same currency as the cash flow which should be discounted, to avoid a false result due to different inflation rates of currencies (Petersen et al., 2017).

Beta

In the CAPM, the stock's expected return is influenced by its beta (Koller et al., 2010). The beta used in the CAPM is an indicator that measures the covariance between the individual company-specific returns and the market portfolio’s stock returns (Petersen et al., 2017). Higher systematic risk, reflected in a higher beta, leads to a higher required return for the investor. This is presented by the following definitions:

ß=0 Risk free investment

ß<1 Equity investment with less systematic risk than the market portfolio

ß=1 equity investment with the same systematic risk as the market portfolio

ß>1 Equity investment with greater systematic risk than the market portfolio

The beta is calculated as the covariance between the performance of the stock and underlying market portfolio. Since practitioners do not agree on a uniform time period duration and underlying market portfolio, analysts from different providers like Bloomberg or Yahoo Finance calculate different results for the beta. As each calculation method has advantages and disadvantages, it is useful for the analyst to take an average of several calculations to calculate the systematic risk, since the errors of the respective calculations may offset each other (Petersen et al., 2017).

Petersen et al. (2017) also introduce two other approaches which can be used to support the previous estimation or can be used in the case of a company which is not listed on stock exchanges. The first approach is to use beta estimation from comparable companies which is carried out as follows. At first, a peer group of comparable listed companies must be identified. As these companies usually have different financing structures influencing the beta, the betas of the peer companies must be unlevered. If the peer group betas are unlevered, an average unlevered beta of the peer group companies can be calculated. In the last step, the calculated unlevered beta is levered in accordance with the financing structure of the target company.

The second introduced approach is the fundamental approach. In the fundamental approach, the analyst assesses the risk of the company based on its own observations and experiences. Company's risk is divided into operating risk and financial risk. Hereby both of the risks are assessed individually based on analysis and classified in three risk levels - low, neutral or high.

The operating risk consists of the external risks, the strategic risks and the operational risks. To evaluate the operating risk, the analyst uses factors like GDP growth or the cyclicity of the business model. Additionally, analysing tools like PESTLE, Porter's five forces or the value chain are also used to analyse the operating risk. The financial risk is based on the financial leverage and the loan characteristics of the company. The loan characteristics include factors like the interest rate type, the duration of the loan, the repayment profile or the underlying currency. Finally, both risk classifications can be used to get an overall risk level that leads to an estimate of the equity beta.

Market Risk Premium

The market risk premium is the difference between the market's expected return and the risk-free rate (Petersen et al., 2017; Koller et al., 2010). It is the excess return that a rational investor expects to earn by holding the market portfolio instead of the risk-free rate. The calculation of the market risk premium is a frequently debated topic in finance and still there does not exist one universal accepted model to calculate the market risk premium (Koller et al., 2010).

Petersen et al. (2017) introduce the ex post and ex ante approach. The ex post approach is a historical analysis of the differences between historical return on the stock market and historical return on risk-free investments. A period of 50 to 100 years is used for the comparison. It is generally assumed that the historical level and development of the market risk premium is a good indicator for the future market portfolio's risk premium. The ex-ante approach uses analyst’s opinion regarding earnings forecast and therefore infer the market portfolio’s implied risk premium. According to Petersen et al. (2017), the average risk premium varied between 5.2% and 5.5% in the past.

4.2.3.3.3. Return on Debt

The required return of debt, also called cost of debt, is the return creditors request for the provision of debt. A company can be financed by various types of debt. The most widespread types of debt are loans, bonds or mezzanine capital. Each type of debt has different characteristics regarding risk, payment term and interest rate (Rosenbaum and Pearl, 2013). Generally, the formula for the required return of debt after tax is as follows:

Required return on debt = risk-free rate + default spread

The risk-free rate is not discussed since it was already discussed in the previous section. The company's return of debts excluding the tax shield consists of the risk-free rate and the credit spread (risk premium on NIBL). Therefore, the literature recommends using the yield to maturity of the company's long-term, option-free bonds (Koller et al., 2010; Rosenbaum and Pearl, 2013). The credit spread is influenced by company’s credit rating. The credit rating uses several financial ratios to calculate the company's probability of default and the loss given default that finally indicates company's risk (Petersen et al., 2017). Brealey et al. (2017) define that the cost of debt should be the rate that the company has to pay on new bonds issued to finance its average risk investment projects.

4.2.3.3.4. Taxes

The company's tax rate is included in the WACC formula. As opposed to dividend payments, interest payments are tax deductible. Through the possible tax deduction, a company has lower tax expenses leading to a higher intrinsic enterprise value. The level of the tax rate is based on the company's marginal tax rate. The effective tax rate of the company is not appropriate as it already includes the tax savings due to the interest payments for debt capital. For multinational companies, the local corporate tax rates and the amount of total borrowings in each country must be taken into consideration. Based on it, a weighted average corporate tax can be calculated, whereby it is important to use the marginal tax rate instead of the absolute tax rate (Petersen et al., 2017).

4.3. Business Life Cycles

Companies pass through different life cycle stages over time. At the beginning, every company is starting as a young start up and work its way through young growth, high-growth, maturity and potential decline life cycle stages. The time spent within every life stage can vary among each company. Whereas Google and Amazon are example for companies who rush through their early life stages and became fast high-growth companies, other companies grew significantly slower. Companies, like Coca-Cola, IBM and Walmart are able to expand their growth periods to endure decades. Some companies often fail to reach mature stages of the life cycle, either because they cannot access new capital or they cannot pay back their debt (Damodaran, 2018).

While experiencing these various stages, a company can generally be defined by various characteristics. These characteristics can be related to the strategy, the financial performance and the organisational structure of the company. Based on the Damodaran’s (2018) classification each potential stage of the company's life cycle is introduced in the following section.

Start-Up

Each company begins its operations by launching a new product or service. The launch phase can be characterised by low, but slowly increasing sales. The business focus is set on research and development as well as marketing and advertising to improve the product and increase the level of awareness among potential customers. Due to the low sales and high costs the profit is negative during the launch stage. Additionally, small investments into assets and working capital reinforce the need of cash and consequently contribute to negative cash flows. Furthermore, companies in the launch stages usually have few employees and a strong founder of the company. Hence, they are more flexible in the launch stage than in any other stages of the lifetime. For start-up companies the source of value is entirely based on future growth.

Young Growth

This growth stage is characterised by rapid sales growth. The business focus is set on market and advertising to increase the overall market size and the market share. Due to increasing sales and declining costs and an increasing production, the company starts earning profit and passes the break-even point. However, in this stage high investments into assets like production lines and working capital are needed. Even if the company earns profit, its cash flows are negative due to high investments. At this stage, the number of employees in the company increases. The high capital requirements are fulfilled by taking out new loans and in addition by selling company shares to investors. However, the founder generally retains majority ownership. For young growth companies the source of value is mostly based on future growth.

Mature Growth

During the shake-out stage the sales still increase, but with a lower rate than in the previous stages. The business focus is identical to that of young growth companies. At this stage, the profit rises due to continuous sales growth in combination with increasing cost efficiency leading to a positive and increasing cash flow. At this stage, the number of employees in the company increases but with a lower rate than in the previous stage. The high capital requirements are fulfilled by taking out new loans and in addition by selling company shares to investors. Thus, the ownership share of the founder is significantly lower in contrast to the previous stage. For mature growth companies the source of value is based partly on existing assets but for a larger part on future growth.

Maturity

The maturity stage can be characterised by the start of steady sales and the sales peak is reached. The business focus is set on cost efficiency and increasing the profit margins. The cash flows are staying almost stagnant and are reaching their peak during this stage. In this stage companies generally start to invest into new business ideas or acquire new companies to ensure their existence and future profit possibilities. Additional financial engineering is applied to increase companies' value. For mature companies, the source of value is largely based on existing assets and to a smaller part on future growth.

Decline

The declining stage can be characterized by decreasing sales. The business is set on looking for new business companies. Next to the decreasing sales companies' margins are shrinking as well either because the companies are losing pricing power, or they reduce prices to counteract declining sales. Consequently, the cash flow is decreasing. For declining companies, the source of value is entirely based on existing assets.

5. Introduction of Tesla

This section is introducing the case company Tesla. A particular focus is set on the transformation process of Tesla from a small start-up company to the world leader in electric mobility and outline Tesla’s strategical, operational and financial characteristics.

Tesla Inc. is a developer, designer, manufacturer and seller of high-performance electric vehicles and energy generation and storage systems. The overall mission of Tesla is “to accelerate the world's transition to sustainable energy” (Annual Report, 2019).

The US-based global operating company has approximately 48,000 full-time employees and is headquartered in Palo Alto, California (Macrotrends, 2020). It was founded in 2003 by the two engineers Martin Eberhard and Marc Tarpenning in the Silicon Valley. The company's name is inspired by the inventor of the induction motor, Nikola Tesla. In 2004 Elon Musk, the founder of Spacex and PayPal, invested $30 million in Tesla and became the chairman of the board of directors.

In 2008 two important events happened for Tesla. Firstly, both founders left the company. The reason for their withdrawal was a dispute between Musk and Eberhardt about production difficulties, why Eberhard was replaced as CEO and left the company sometime later. Subsequently, also Tappening left the company and Elon Musk became the new CEO of the company (Vance, 2015). Secondly, Tesla started with their production of their first electric car, the Tesla Roadster (Reed, 2020).

In 2010 Tesla went public on the NASDAQ stock exchange. 13.3 million shares were issued with a price of seventeen dollars per share. The IPO can be seen as a remarkable event, since the last IPO of an American automotive company was more than fifty years ago. Meanwhile, Tesla reached a market capitalization of 75.742 billion on 31st of December 2019. In 2019 the company achieved a revenue of 24.578 billion and a net loss of 862 million. 94% of the revenue was generated in the automotive segment and 6% in the energy storage and generation segment (Thomson ONE, 2019)

5.1. Master Plan, Part One

The overall mission of Tesla is to shift the current mine-and-burn hydrocarbon into a solar economy (Musk, 2016). To implement this mission Tesla developed a four-step Master Plan which was published by Elon Musk on their website in 2006. One decade later in 2016, Elon Musk published the master part two. Based on the two Master Plans, Tesla's strategy can be derived. In the following, both Master Plans are introduced and Tesla's developments and achievements along these plans are explained.

Tesla's first Master Plan includes four steps:

1. Build sports car
2. Use that money to build an affordable car
3. Use that money to build an even more affordable car
4. While doing above, also provide zero emission electric power generation options

The first step in the Master Plan describes the development of a low volume high priced car. "The strategy of Tesla is to enter at the high end of the market, where customers are prepared to pay a premium, and then drive down market as fast as possible to increase unit volume and lower prices with each successive model" states Elon Musk (2006). As a result, the first electric vehicle from Tesla, the Tesla Roadster, was developed and produced from 2008 to 2012. In comparison to other electric vehicles, the Tesla Roadster had outstanding statistics for that time. It achieved a remarkable range of 394 km in company tests. The performance was competitive against many gasoline-powered sports cars. The acceleration from 0 to 100 km / h could be reached in less than four seconds and the maximum speed was 200 km / h. With a price of $109,000 the car was placed in the luxury segment. Until the end of 2012 the Roadster was sold 2,500 times in total. Thus, Tesla had reached the first step of the Master Plan one (Stringham, Miller & Clark, 2015).

Tesla put their entire free cash flows and additional funding into the development of a new electric car to realize step two of their plan, bringing a more affordable car into the market. Consequently, Tesla finished the production of the Tesla Roadster and started with the production of model Model S in 2012. Although the original Master Plan only included one car in step two, Tesla adapted its product range to meet customers' requests and started the production of Model X in 2015 (Annual Report, 2015).

Model S is a four-door full-size sedan with a delivery start in June 2012. Starting price for this model is $74,000, the car accelerates from 0 to 100 km / h within 2.6 seconds and it has a range of 610 km. With the Model S Tesla introduced its unique key features, such as the large touchscreen driver interface, autopilot hardware, over-the-air software updates and fast charging through their globally arising Supercharger network. In 2013 the car was awarded for one of the automotive industries' highest honours, the motor trend car of the year, for its technical performance and its design. The Model S has been the first electric that receives the price. (Matousek, 2019; Annual report, 2019; Tesla, 2020).

The third vehicle of Tesla's product line, Model X, is a mid-size SUV with seats for up to seven adults. The starting price is $80,000 and it is delivered since 2015. The federal regulators awarded the Model X as the safest SUV of all time with the highest possible safety ranking. The heavy lithium-ion battery on the ground of the car leads to a lower centre of gravity in contrast to combustion engines. That difference causes a less vulnerable rollover effect. The SUV stands out due to its unique falcon wing doors and an all-glass panoramic windshield. According to Tesla, the car is the quickest SUV on the road with an acceleration from 0 to 100 km / h within 2.9 seconds. The range of the Model X is over 500 km (Isidore, 2017; Annual report, 2019; Tesla, 2020).

With the production start in 2017 of the Model 3, Tesla accomplished one of their most critical steps in their Master Plan since the company was able to produce a car for the mass market. The Model 3 has a starting price from $40,000 dollar, an acceleration from 0 to 100 km / h within 3.4 seconds and a range of 540 km. Elon Musk describes the difference between the Model 3 and Model S in a twitter post from 24th of March 2017 as follows: "Model 3 is just a smaller, more affordable version of Model S w less range & power & fewer features. Model S has more advanced technology." The lower features enable Tesla to offer a relatively lower price making the car suitable for the mass market. However, Tesla struggled at the beginning to achieve their target production goal, but in the end of 2018, they reached their goal of producing 5,000 cars per week. Since then, they continuously raised their production outcome (Brown, 2017; Gibbs, 2018; Annual report, 2019; Randall and Halford, 2020).

The last step of Tesla's first Master Plan involves the simultaneous development of electric power generation options. Thereby, they are not only focusing on the electric generation, they are also developing electric storage solutions. An important milestone for Tesla along the way was the acquisition of Solar Roof in 2016 (Annual Report, 2016).

Currently Tesla has three energy storage products, Powerwall, Powerpack and Megapack. Powerwall was launched in late 2016 and is intended to store energy for privates' houses or commercial facilities. The energy storage device consists of a 13.5-kilowatt hour rechargeable lithium-ion battery with integrated inverter. The delivering of Powerback and Megapack products began in 2018 and in 2019, respectively. Both energy storage products are, opposed to Powerwall, designed for commercial, utility and energy generation customers. Powerback has an energy capacity up to 232-kilowatt hour and Megapack has an energy capacity up to three-megawatt hour battery packs. Multiple units can be grouped together for a bigger capacity (Annual Report, 2019).

The second product range within the Master Plan's fourth step is the generation of solar energy solutions. Tesla sells solar panels, which can be fixed on the ground or roof and convert sunlight into electrical current. Currently, Tesla is selling their third generation of the product and trying to increase the volume in the production. By selling the solar panels in combination with the energy storage products, Tesla wants to provide their clients with holistic energy solutions (Annual Report, 2019; Tesla, 2020).

5.2. Master Plan, Part Two

In 2016 Elon Musk published Master Plan two on Tesla's website. Musk stated in the announcement that Tesla almost accomplished all steps of Master Plan one. In the Master Plan two Elon Musk (2016) emphasized again, the need for the shift to a sustainable economy:

"By definition, we must at some point achieve a sustainable energy economy or we will run out of fossil fuels to burn and civilization will collapse. Given that we must get off fossil fuels anyway and that virtually all scientists agree that dramatically increasing atmospheric and oceanic carbon levels is insane, the faster we achieve sustainability, the better."

In this light the Master Plan two was developed:

1. Create stunning solar roofs with seamlessly integrated battery storage
2. Expand the electric vehicle product line to address all major segments
3. Develop a self-driving capability that is 10X safer than manual via massive fleet learning
4. Enable your car to make money for you when you are not using it

The first step is a more concrete version of step four from Master Plan one. Since the ideas about the energy generation and storage segment were already introduced, they will not be further discussed again.

Step two of the Master Plan explains the future development of Tesla's product range. In accordance with the plan, Tesla started with the production and selling in the first quarter of 2020 of a compact sport SUV, Model Y, that is built on the Model 3 platform. Additional future plans include a new Tesla Roadster, a Tesla Cybertruck and a Tesla Semi. With the expansion of the product range Tesla pursues the aim to target a wider range of customers (Annual Report, 2019).

The Tesla Roadster is the fastest sports car in in terms of acceleration with a time from 0 to 100 km / h within 1.9 seconds, a maximum top speed over 400 km / h and a range over 1,000 km. With a price of $200,000 it can be placed, as its predecessor model, in the luxury segment. The launch date is planned after 2020 (Annual Report, 2020; Tesla, 2020).

The Cybertruck is an electric pickup that was presented to the audience in 2019 and the production start is estimated for late 2021. The pickup has a range up to 800 km and a starting price from $39.000. The truck has an extraordinary design and is built with an impenetrable exoskeleton and armoured glass for maximal strength and endurance. During the Cybertruck presentation Tesla revealed the audience that a sledgehammer cannot cause any damage to the truck (Tesla, 2019; Tesla 2020)

With the Tesla Semi, the company is entering into the truck market with a price of $200,000. The electric truck is described on the company's website as the safest, convenient and maximum powered truck on the market (Tesla, 2020). The trucks accelerate from 0 to 100 km / h within 20 seconds compared to 60 seconds for a fuel truck. Another big difference between usual trucks and the Tesla Semi is the seating position. As opposed to normal fuel trucks the seating position in the Tesla Semi is in the middle, enabling the driver a maximum visibility and control and a low center of gravity (Musk, 2017). For its Semi truck Tesla claims a substantial reduction in the cost of cargo transport of $200,000 achieved by fuel savings. However, the diesel industry questioned the proof of it (Lambert, 2018).

Tesla has not reached full autonomous driving, which is step three of their Master Plan. However, they are continuously working on this solution and Elon Musk announced on Tesla's autonomy day in 2019 that they developed a chip specifically for their own self-driving software to run their self-driving solution. Since 2019 Tesla is equipping all vehicles with the needed hardware to enable self-driving cars for a fully autonomous future that provides safety and comfort for their customers. Field data is collected through on-board cameras, radar, ultrasonic and GPS, that is used to further enhance and improve their neural network and thus the self-driving capability (Annual Report, 2019). So far, Tesla's cars provide a few advanced driver systems of their autopilot and full self-driving services. These are for example auto-steering, traffic aware cruise control, automated lane changing, automated parking and driver warning systems. Although Tesla claims that the autopilot enables a more convenient drive due to less driver intervention for the driver, yet Tesla emphasizes that the driver is finally responsible for the car. Tesla draw a comparison with an autopilot in airplanes, in which the autopilot is also only used when conditions permit. The predicted start for the full serving software for early access user is the end of 2020. A prerequisite for autonomous driving is still the need for regulatory approval (Annual Report, 2019; Musk, 2019).

In the final step of Master Plan two Tesla wants to create a ride-hailing network. Car owners should be able to have a further income stream by the participation with their car as part of the network. The cars are connected with an app and can be rented as a robot driver to passengers, when the owner does not need the car. Musk's describe the business model as a combination of Uber and Airbnb. Tesla promises a $30,000 additional income stream for car owners per year (Brown, 2019; Musk 2019). An absolute key element for the ride-hailing network is the further development of the autonomous driving. With the introduction and government's approval of autonomous driving this goal can be achieved.

Simultaneously, Tesla provides and further expands a supercharger network in their key markets to speed up the global usage of electric vehicles. Tesla has five different geographic segments where the revenue is generated. By far the largest market for Tesla is the United States with a revenue share of 51%. Additional markets are the markets in China with 12%, the Netherlands with 6%, Norway with 5% and the residual 25% are shared between various other countries.

5.3. Ownership Structure

As of the 31st of December 2019 Tesla, had approximately 181 million outstanding shares. The owners can be classed within two categories, insiders and free float. 20.26% of the shares are held by insiders. The biggest inside owner is Elon Musk with 18.11% in relation to all outstanding shares. The other number of shares is floating stock, available for trading.

The largest group of floating stocks owners are Investment Managers with 43.27% of all outstanding shares. The greatest investment manager is the Capital Research & Management Co. with 5.6% of all outstanding shares. Privat investors or unknown investors hold 36.47% of all outstanding shares. In geographical terms US-based investors capture 60.5% of the shares. Through the large number of shares in free float, it can be concluded that the shares are easily tradeable (FactSet, 20). The exact distribution can be seen in appendix 6 and 7.

5.4. Share Price Development

The Tesla stock went public in 2010 with an initial price of $17. Since 2011 the share has increased with a CAGR of 55%, however the share price was subject to extreme fluctuations. The largest annual growth happened in 2013 with 344.1%. At the end of the year 2019 the share price was at $418.33. In the following, Tesla’s stock price development is described and is related to Tesla's key progresses (Macrotrends, 2020).

From 2010 until 2012 Tesla’s stock price was comparatively steady, despite the sales launch of Model S in the middle in 2012 (Kain, 2016). The year 2013 resulted in Tesla’s highest relative share price increase. For the first time the company reported a quarterly profit in the first quarter with $11 million after US-Gaap. After this announcement of the quarterly figures on May 8th, 2013, the share price increased from $55.79 to $193 until October 1st, nearly two and a half times. Afterwards, the share price decreased by 37% again due to a few Model S caught on fire leading analysts to downgrade the share. High customer satisfaction rankings for Model S leads to another increase at the end of the year (Valdes-Dapena, 2013; Kain, 2016).

In the years 2014 and 2015 the share price had high fluctuations. A positive analysis report by Morgan Stanley in the beginning of 2014, the announcement of the building of the large-scale Gigafactory in the end of 2014 and Elon Musk’s statement about the introduction of the Powerwall to Tesla’s product portfolio in the end of 2015 pushed the price up. But lower than expected earnings per share, Elon Musk's evaluation of an overpriced stock price from Tesla, delayed delivery of Model X, weak China sales, lowered delivery estimates and lowered price targets pushed the price again and again downward during these years (Kain, 2016).

The year 2016 started with a large decrease in Tesla’s stock leading to the lowest price since 2014. Analysts downgraded Tesla’s price target and classified the stock as a sale (La Monica, 2016). Afterwards the stock price grew to $250 after the first quarter report. However, due to greater than expected capital requirements for an expedited production the share price was influenced negatively. In the second half of the year the price remained relatively stable (ThomsonOne, 2020)

The year 2017 was finished with a share increase of 46% that was marked by high fluctuations as well. On the one hand, the launch from Model 3 led to a general positive trend over the year reflected in an increasing share price. On the other hand, before the midyear launch Tesla’s ability to produce high volumes of the car were questioned. These doubts were eliminated after the sales launch leading to a high price growth. Afterwards the price had a volatile run since the company was not able to run their assembly line efficiently (La Monica, 2017; Rosevear, 2018).

Another bumpy ride characterized Tesla stock in 2018, nevertheless, the stock was the best automotive share during the year with regard to the relative share price increase. A chart analysis indicates that during that year the stock fluctuates with a range of 40% around the S&P 500 index. The whole year was driven by many announcements like the future launch of the new Tesla Roadster. The share price reached a peak after Musk announced in a tweet that he plans to privatise Tesla. As a result, he immediately got a SEC investigation, which pushed the share price down and he had to withdraw as a chairman (DeBord, 2018; DeBord, 2020; Korosec, 2019).

The share price development of Tesla in 2019 seemed to be like a “rollercoaster ride” (Ramkumar, 2019). In the first half of the year the stock price decreased from $332.8 to $178.9 impacted by fluctuating deliveries and quarterly losses. However, some positive news boosted Tesla's stock in the second half of the year. Due to an unexpected profit of $342 million in the third quarter, the stock price rose significantly. High sales figures supported the upward trend and led to a stock price of more than $400 at the end of 2019 (DeBord, 2019).

5.5. Financials

This section outlines Tesla's current financial situation and their past development. The period under review refers to the financial statements and financial market data from 2015 until 2019. This section is divided into the three parts based on the structure of the three financial statements with a focus on measures required in the calculation of the free cash flow and the technical valuation. All financials are attached in the Appendix 1-5

Income Statement

In 2019 Tesla generated a revenue of $24,578 billion and had operating costs of $24,498 billion. In combination with other costs like interest payment or income taxes, Tesla reported a net income loss of $862 million.

Tesla generated a revenue of $4,046 billion in 2015 and experienced a compound annual growth rate (CAGR) of 57,0% between 2015 and 2019. However, the annual sales growth rate fluctuated widely between 15% and 83% in the considered period. Besides this, the costs of goods sold (COGS) increased with a higher percentage than revenue, leading to a continuously declining gross margin from 22.8% in 2015 to 16.6% in 2019.

Further significant cost centers are selling, general and administrative expenses (SG&A) and research and development (R&D). Both costs types had a lower increased rate than revenue, impacting the net income positively. Subsequently, the proportion of both costs to the revenue decreased from 22.8% in 2015 until 10.8% in 2019 and from 17.8% in 2015 to 5.5% in 2019 for SG&A and R&D, respectively. Combining the increasing COGS with the decreasing SG&A and R&D cost, the net income remained relatively stable with losses between $675 million and $1,238 billion.

Tesla subdivides its business into the following divisions: Automotive, automotive leasing, service and other, and energy generation and storage. Based on the 2019 revenue split the automotive division generates the largest part of the revenue with 81.2%. Including with the automotive leasing and service and other division, the entire automotive segments had a revenue share of

93.8%, whereas the energy generation and storage division, established in 2015, had a revenue share of 6.2% in 2019.

Even though, the share of the automotive division of total revenues fluctuated in the considered period between 72.6% and 84.8%, the share remained almost stable in the last two years with 82.2% in 2018 and 81.2% in 2019. As the automotive section had always been the division with the largest share of the total revenue, with an average of 80.1% in the last five years, the main focus will be on this division.

The automotive division of Tesla increased its revenues from $3,432 billion in 2015 up to $19,952 billion in 2019, representing a CAGR of 55.3%. Especially the market launch of Model 3 increased the revenue of Tesla, leading to a revenue growth of 107% in 2018. The gross margin within the automotive division remained quite stable during the considered period with margins between 20.1% and 23.6%.

Balance Sheet

At the end of the year 2019 Tesla had a balance sheet total of $34,309 billion. Based on the balance sheet total of $8,092 billion in 2015 this is an absolute growth of $26,217 billion. On the active side 35.3% of the balance sheet are current assets and 64.7% of the balance sheet total are non-currents assets. On the passive side equity accounts for 23.6% and liabilities account for 76.4%. The liabilities of $26,199 billion consist of 40.7% current liabilities and 59.3% non-current liabilities.

According to the definition of Tesla for their working capital which includes all short-term assets and liabilities, the working capital fluctuated between $(1,685) billion and $1,436 billion. Based on the definition of Petersen, et al. (2017) that only includes the inventories, accounts receivables and accounts payables, the working capital fluctuates between $389 million and $1,105 billion.

In the last years depreciation continuously increased from $423 million in 2015 to $2.15 billion. This growth is in line with Tesla’s increasing long-term assets. The capital expenditures differed significantly in the last years. Of particular influence has been the construction of Tesla's Gigafactory in year 2017, resulting in twice times higher capital expenditures compared to the average of other years. Taking the entire period into consideration, Tesla's capital expenditures are on average $770 million higher than annual depreciation.

Cash flow statement

Tesla’s operating cash flow statement result improved substantially in the last years. Starting with a negative cash flow of $(525) million, the operating cash flow enhanced to $2,405 billion. The investing cash flow of Tesla is mainly driven by its capital expenditures. As stated in the previous paragraph, Tesla's capital expenditures and consequently the investing cash flow are almost entirely influenced by Tesla’s investments in their current and future factories. The financing cash flow has always been positive in recent years. With the additional issuance of stocks, the execution of stock options and a higher borrowing than repayment of long-term liabilities, Tesla finances its future growth. The free cash flow to firm used in the DCF model has been negative between the years 2015 and 2018 and was for the first time positive in 2019 with $969 million.

Capital Structure based on Market Capitalization

The analysis of Tesla’s capital structure refers to the 31st December of each year. Hence, fluctuations within the years are not considered. In 2019 Tesla had an equity share above 90% and a share of debt of slightly below 10%. Tesla's capital structure remained stable in the past years with an equity share between 85% and 95%. Since Tesla experienced a high share price growth in the last few years, it can be derived that Tesla adjusted its net debt in almost the same percentage as the share price increased.

Classification of Tesla into the company life cycle

Based on our company life cycle description from the theory section, Tesla can be classed as a mature high-growth company. As stated in the company description Tesla’s sales growth was between 68% to 83% in the years from 2016 to 2018, however in year 2019 it had fallen to 15%. This indicates that Tesla still has a high sales growth, but that the sales growth is substantially lower than in the previous years. Through the high focus on new automotive models and autonomous driving, the business focus is still set on research and development. The large media presence of Elon Musk and Tesla further serves to increase the level of awareness of Tesla and its products. Additionally, Tesla achieved a positive free cash flow to firm that is in line with the definition of mature growth companies and enhanced their net income between 2017 and 2019 due to increased sales and improved cost efficiency. A further indicator for the classification of Tesla into a mature growth company is the decreasing growth rate of employees in the last years.

The number of employees increased from approximately 13,000 in 2015 up to 48,000 in 2019, however the largest increase took place in 2015 and in 2019 the number of employees stayed almost on the level of the previous year. In the last years Tesla continuously issued new shares and raised its long-term debt to finance its growth plans. As a result of the issue of new shares, the shares of the former owners have been diluted, with the result that Elon Musk only holds around 18% of Tesla's outstanding shares. Even if Tesla already generates sales through its existing assets, the source of value is still based on a larger part on the future products and business ideas. All above mentioned characteristics prove that Tesla is a mature high-growth company.

6. Analysis

The DCF model of Petersen et al. (2017) is divided into three parts: (1) Identification of strategic value drivers; (2) Transformation of strategic value drivers into financial value drivers; and (3) Technical part. In the following analysis the first and the second step are combined under the header “forecasting”. Both, the “forecasting” and the Technical part will be analysed in the following way: In the first step potential problems with the DCF model of Petersen et al. (2017) will be analysed using Tesla as the case company. In the second step potential solutions to overcome the identified problems are presented.

Forecasting

One of the most important stages in the valuation process is the prediction of the future cash flows, since it is the largest influential factor on the intrinsic enterprise value. Precisely forecasting future earnings causes problems for almost all analysts. Already in the 1930s the two analysts Graham and Dodd (1934) warned about the difficulties of a precise forecasting process. An in-depth analysis about analyst errors is in line with the statement from the two authors. During a fifteen-year long investigation of the forecast accuracy conducted by Wall Street analysts, Dreman and Berry (1995) reported a remarkable difference between forecasted and actual earnings in the forecasting process of common valuation models. Over time, the forecast errors turned out to be even bigger. Hence, the study revealed the occurring problems within forecasting and indirectly criticises different valuation models.

However, Petersen et al. (2017) does not take the identified problems into consideration. The three authors state based on an analyst forecasting study that there is “a disagreement about the earnings potential of a given firm”. Their given solution is to “devote the necessary time and effort in developing estimates that are supported by useful sources and excellent analysis” (Petersen et al. 2017, p. 281). They assert that an analyst can easily forecast future cash flows for the standard DCF model. The following paragraph challenges this claim for high-growth companies like Tesla. The forecasting process is divided into two sections. The first section deals with the identification of the strategic value drivers while the second section is concerned with the transformation process of these strategic value drivers into financial value drivers and subsequently into a forecast of future cash flows.

6.1. Strategic Value Driver Analysis

The strategic value drivers lay the foundation for the future earnings potential of a company and heavily impact the valuation. The strategic value driver analysis is divided into an external analysis and an internal analysis. The external analysis consists of a PESTLE analysis and an analysis of Porter's five forces, while the internal analysis is conducted by use of a value chain analysis. All the above-mentioned models have a strong reputation among researchers and practitioners, since they are able to depict the complete macro environment, the competitiveness of the industry and the value of the internal processes of the company respectively (Helmold and Samara, 2019). Nevertheless, there are also some drawbacks in the models, which have been further strengthened through the accelerating transformation of the business environment. These disadvantages are pointed out in the next section and are related to the case company Tesla.

6.1.1. PESTLE Analysis

Nowadays, a PESTLE analysis cannot be considered as easy and straightforward. The world is rapidly changing, and many unforeseeable events have occurred over the last years, for instance on a political and economic level. Or did somebody guess a few years ago that Trumps protectionism politics would quiver the foundations of global trade or that the ongoing corona crisis would have such a significant impact on the global economy and consequently include these effects into the DCF model? (White, 2020) The dynamic and changing macro environment has to be taken into consideration in the PESTLE analysis.

However, the PESTLE analysis does not acknowledge different macro environments and assumes a stable and unchanging environment that is predictable. The underlying theory of a stable environment cannot be considered as a proper depiction of reality, since already in the 1960s, Emery and Trist (1965), defined four different categories of environments. The different categorisations of the macro environment are arranged in an ascending order, ranging from a calm environment to a turbulent environment. The four different definitions are as follows:

1. "Placid and randomized", in which the environment is stable and unchanging.

2. "Placid and clustered", in which the environment is stable but with greater connectedness between organizations and environmental variables

3. “Disturbed and reactive”, in which the environment is changing, and organizations engage in an ongoing process of competition.

4. “Turbulent”, where the environment is constantly changing and redefining the basis of organizational success.

The PESTLE analysis does not include these various environmental conditions. Burt, Wright, Bradfield, Cairns and van der Heijden (2006) also criticise the approach of a stable and unchanging environment that is predictable. The five authors argue as follows: “Guidance in the textbooks focuses on analysing a current environment that is presupposed to be static rather than attempting to comprehend how the environment has evolved and how and why it may evolve in particular ways in the future” (Burt et al., 2006, p. 55). The model is not covering the development from the past to the current situation and also not covering from the current situation into the future and is therefore not entirely able to deal with changing and uncertain environments.

Furthermore, Burt et al. (2006) extend their critique by stating that the PESTLE analysis offers no explanation for interdependencies between the variables within the PESTLE framework. The PESTLE analysis ignores the fact that a change in one of the variables will lead to an inevitable change in another variable, that may cause a cascade effect for other variables as well. Instead, the PESTLE analysis presumes a static model, in which the different factors are not affecting each other. Whereas mature companies might be operating in environments that can be better characterised as a “placid and randomized” environment, high-growth companies run their operations in a rather “turbulent” environment. High-growth companies often enter markets that are characterized by a high degree of uncertainty and change, either because the markets were created by them or because the change in the markets was originated by them. Every kind of change - either political, technological or social - comes along with uncertainty about the future. Therefore, the future is more difficult to predict for new markets compared to existing markets, where the macro environment has already established itself (Koller et al., 2010).

In the following paragraphs Tesla’s macroeconomic environment and potential interdependencies between the different factors of the PESTLE analysis are analysed. Furthermore. The question is asked whether the PESTLE analysis is able to properly capture all the aspects of Tesla’s macro-economic environment. In the analysis, examples from different perspectives are used, however, not all relevant points have been able to be captured.

Political factors have a strong influence on Tesla's future sales, especially government incentive schemes are crucial. Many countries all over the world incentivize purchases for electric cars to accelerate the change of the vehicle market towards sustainable mobility. Three different types of incentives are used by governments: financial incentives, tax savings and bureaucratic advantages. To illustrate, Germany has a €4,000 purchase grant for electric cars and a ten-year tax exemption for electric vehicles bought between 2011 and 2020 (Haufe, 2019). Buyers in the US receive an amount between $2,500 and $7,500 of tax credit for new electric vehicles which is calculated according to the size of the vehicle and its battery capacity. Besides Germany and the US almost all governments of Tesla's target markets offer incentives for the purchase of electric vehicles (Volkswagen, 2020).

Currently, the monetary incentives are fostering Tesla’s sales. However, it is hard to forecast how long incentive programs will continue. One can assume that, if incentive programs expire, sales will be negatively affected. The point in time when incentive programs will be cancelled will affect the intrinsic enterprise value of the company, since sales will decrease. The impact on the intrinsic enterprise value will be different regarding whether the incentives will stop in five, ten or fifteen years, but it is impossible to predict the exact point in time this will happen.

According to a study by Oliver Wyman (2018) on the German mobility market, the share of electric cars will reach one third of the overall car market in 2035 (Manteuffel and Fritz, 2018). This will result in massive challenges for the German power grid system, as the low-voltage level is not designed for this large number of electric cars. A 30% share of electric cars can already result in widespread power failures. To not inhibit the growth potential of the electric car market, political decision makers have to support the German energy grid expansion. If not, Tesla's future sales might be negatively affected.

Another macro environmental factor to consider is the economic environment. Even highly experienced economists’ predictions are often inaccurate (Waldermann, 2009). In particular, car manufacturers are highly influenced by the economy (Oliver Wyman, 2013). Especially during an economic crisis, it has to be questioned, if customers are still willing to pay a premium for electric cars in comparison to a combustion machine. However, as there are no historical data on this since Tesla has never been in an economic crisis, assumptions have to be made.

The third influencing factor in the PESTLE analysis is social influence. In this regard, the prediction of the degree of general acceptance of autonomous driving plays a crucial role for Tesla. In order to gain a high degree of general acceptance, consumer attitude and behaviour towards mobility must change fundamentally. Predicting if and when this process will take place is difficult to forecast. In a study by AlixPartners (2020) about autonomous driving, these concerns have been confirmed. Currently, only 18% of the German people believe in the safety of autonomous driving, while 80% of potential buyers of highly automated autonomous vehicles do not want to be pioneers. Although they are seriously interested in autonomous vehicles, they would wait for at least five years after market launch before buying them. In contrast, the attitude towards robotaxis are different, as 84% of the consumers surveyed in China stated that they would give up a private vehicle, if the cost of booking an autonomous ride-hailing service is no higher than the cost of maintaining their own car. Furthermore, according to the study, interest in robotaxis and similar automated services is high across all countries. Even in traditional car countries such as Germany and the USA, 52% and 44% respectively, would not purchase an own car in this case (AlixPartner, 2020). In addition, it remains to be seen how many Tesla users are willing to rent their vehicles to strangers who will drive around in them. Until now, cars have often been regarded as a status symbol and private property. It needs to be questioned whether this attitude will change towards cars being a cash generating asset in the future (Yoon, 2019). The reaction of consumers towards this shift will only be revealed in the future (AlixPartners, 2020).

The ongoing movement towards sustainability is another social influencing factor for Tesla. Movements like *Fridays for Future* build up indirect pressure to live in a more sustainable way including renouncing freedom of individual mobility or at least abstaining from the use of combustion machines (Caldwell, 2019). In order to adhere to driving restrictions that have been established in larger German cities prohibiting the use of combustion machines, potential buyers are indirectly forced to buy sustainable electric cars (Burger, 2019). The described issues pose a problem for the analyst, as it is difficult to predict when the change in society towards autonomous driving and sustainable mobility will occur. In line with all other macroeconomic influencing factors, social factors are also characterized by their difficult future predictability.

Moreover, technological influences in the macro environment of Tesla’s products should not be underestimated. Tesla is planning to invest yet another income stream towards its ride sharing app for customers, which requires autonomous driving. However, many experts have pointed out the concern that they see the development of a fully functioning 5G network as a prerequisite for autonomous driving. The current 4G network is able to exchange status updates or request rides, but it is not able to give the cars human-like reflexes that are needed to safely drive a car (Telekom, 2020; Khosravi, 2018). This would be the last step towards the fulfilment of autonomous driving. Currently, Tesla only drives at level two out of five, where the driver must still be able to intervene and has ultimate responsibility of the vehicle. However, during the autonomous day organized by Tesla, 5G was not mentioned as a prerequisite to autonomous driving. Instead, merely an announcement was made that autonomous driving will be possible in 2020. For an analyst it is much more difficult to evaluate this problem, since the different opinions between experts and the company make a prediction regarding the prerequisite of the 5G network for autonomous driving challenging. The fact that Tesla has not kept its promises several times in the past does not make it any easier (Aitken, 2019).

Another potential technological threat for Tesla is the development of other drive systems and technologies. The electric car is currently the best developed renewable mobility system, but another potential threat to electric propulsion are fuel cells. The Business Insider recently published an article titled "Why hydrogen cars will be Tesla's biggest threat" (Caldwell, 2020). In this article, the author discusses the dangers for electric propulsion posed by the threat of fuel cells, resulting from three advantages of hydrogen over electric vehicles. Firstly, the full charging of fuel cells needs only five minutes compared to over an hour for electric vehicles. Secondly, fuel cell-driven cars provide a better average range of up to 600 km as opposed to the average range of around 400 km for electric cars. Thirdly, there are substantial potential cost savings when the production of fuel cells reaches economies of scale. Hyundai and Toyota in particular are pioneers in this area and already placed their first cars on the market (Caldwell, 2020). However, Forbes magazine stresses the problems of hydrogen cells, such as the high costs and dangers of storing, transporting and using hydrogen – a highly flammable gas (Templeton, 2020). The examples illustrated above demonstrate that the mobility industry, including Tesla, is driven by high technological uncertainty and many uncertain developments.

Additionally, legal aspects, in particular the laws for autonomous driving influence Tesla significantly. Without a legal framework for autonomous driving, the ride sharing network cannot be launched. This type of problem is common for high-growth companies since they frequently create new markets without the existence of corresponding legal frameworks. Musk stated in

Tesla's annual shareholder meeting that they only have to convince the regulatory authorities to set up a legal framework for autonomous driving as a last step towards its fulfilment (Tesla, 2019). Currently, every EU country and every federal state in the US has its own regulations (Daimler, 2020). It is not possible for an analyst to predict a date for permitting autonomous driving for each separate country or state. This makes forecasts about the future implementation of the ride-hailing app even more difficult. Of course, there is, even for mature markets, no 100% certainty what the future will bring, but the regulatory procedures in mature markets are generally better predictable.

Environmental influences also affect the mobility market of the future. The trend towards a sustainable economy is spreading at an increasing pace worldwide, leading to potential resource risks for Tesla. To illustrate, powerful lithium-ion batteries used by Tesla require goblin as an essential resource. The global demand for lithium-ion batteries in 2026 is expected to be 14 to 24 times higher than its demand in 2016 (Arnold, 2019). The increasing demand for goblin and its limited availability can cause significant supply risks for Tesla. Generally, the battery in electric cars has a goblin content of 12 to 14 percent. A few months ago, Tesla reported that the latest generation of Model 3 batteries only contains 2.8% goblin (Eckl-Dorna, 2019). This demonstrates that the electric car companies including Tesla are already investing in the development of solid-state batteries, which do not require any goblin. Whether these goblin-free batteries will be completely developed and ready for production before a potential supply shortage of goblin occurs, remains to be seen.

Even though the proportion of trucks in road traffic is only 5% in Germany, trucks are responsible for 32% of the CO_2 emission in road traffic. Hence, a CO_2 reduction through alternative drives for trucks would reduce the CO_2 emissions caused by road traffic enormously. The German government is considering two solutions to reduce the CO_2 production from trucks, either expanding the rail freight network or shifting towards environmentally friendly trucks (Chazan, 2020). Comparing the €86 billion investment program into the German railway system with the current support program for electric trucks, which amounts to a minimal budget of ten million per year, a clear preference by the German government can be deduced. As opposed to Germany, other countries may potentially choose the promotion of alternative ways of driving for solving the CO_2 problems and offer high-growth potentials for Tesla's Semi truck. The environmental advantages of the Semi truck cannot be denied, but to reach an increasing level of sales, a high level of political support is necessary, which can be different for every country (European Union, 2020).

The above-mentioned problems show the uncertain environment in which Tesla operates. Different possibilities about future development are ascertained, and it is difficult to predict what will happen and when it will happen. Tesla’s macroeconomic environment can be described as a highly uncertain and “turbulent” environment according to the definitions from Emery and Trist (1965). Thus, the PESTLE analysis is not entirely capable of depicting Tesla’s dynamic and changing environment. This analysis is solely based on the current market environment, as it has been described in extant literature. The PESTLE analysis is only slightly able to incorporate future developments for high-growth companies, while future market developments are highly important for company valuation. Since only the current situation is analysed and not future developments, it lacks to incorporate these changes.

In addition, Tesla also has a high amount of interdependencies between the different factors of the PESTLE analysis which will be demonstrated with two examples. Autonomous driving is a strategic value driver influenced by several different macroenvironmental factors, as it depends on regulatory approval, social acceptance and technical practicability. For a successful implementation and usage of autonomous driving, all three factors must occur together. The lack of one factor will already prevent the success of autonomous driving. Furthermore, the major prerequisite for a wide usage of electric mobility is the expansion of electric grids. For example, in Germany current power grid cannot charge a high number of electric vehicles simultaneously. This problem is also highly relevant for many countries worldwide. The expansion of the electric grid is to a large extent the responsibility of politics but can be induced by the social pressure or a booming economy (Diermann, 2019).

It can be concluded that within Tesla’s turbulent and dynamic environment many different macroenvironmental factors are interdependent. However, the PESTLE analysis does not properly reflect this. Worth noting is that it seems questionable whether today's dynamic world can be shown in an analysis with six independent factors at all. It can be concluded that the PESTLE analysis is not well suited to analyse dynamic and changing environments like the new mobility market. Although the PESTLE analysis may be able to depict a superficial landscape of a company’s environment in a “placid and randomized” stage, it lacks the ability to include future changes, uncertainty and interdependencies between the different factors.

6.1.2. Porter’s Five Forces Analysis

The following section deals with the general problems of Porter's Five Forces analysis. In the next paragraphs, the problems of Porter's analysis are illustrated and mirrored to Tesla. One of the most common and widely used tools of industrial analysis is Porter's Five Forces (Helmold and Samara, 2019). According to Petersen et al. (2017), the tool is a useful guide for identifying the attractiveness of an industry. Porter's Five Forces Framework was developed several decades ago, primarily for industrial companies such as Coca Cola, Ford and Dell (Sheehan, 2005). Today, however, high-growth companies have changed significantly and the environment they operate in has evolved into a more data driven and technological world with unique business models. The question arises if the popular tool is still able to evaluate the attractiveness of these industries.

In the literature, Porter’s claim of an isolated industry has not escaped criticism. Grundy (2006) vigorously challenged the perception of an industry as a closed circle stating that Porter’s assumption of a closed entity is not veritable. Moreover, the author emphasizes that this perception of an industry is even less accurate in blurring industries. This corresponds to the historical origin of the model since the model was developed several decades ago, in particular for industrial companies. In the past, industries were narrowly defined - such as food, pharmaceuticals, or real estate - and interactions with other industries were barely existent. Nowadays, industries are more cross-linked and consequently, many industries are not separated from each other anymore. Instead, they often create new industries and markets that cannot be classified into a traditional industry categorization. For example, the We Company, once the world's most highly valued start-up, sold workstations via a digital platform. Thus, We Company operates on the one hand in the real estate sector and on the other hand in the technological sector (Govindarajan and Srivastava, 2020; We Company, 2019).

Furthermore, Porter's five forces do not consider potential interdependencies between the different forces, as it is assumed that the four forces are independently affecting the industry’s competitiveness. Grundy (2006) contradicts this assumption and concludes that there are interdependent relationships between the four other factors. The following model depicts the most important interdependencies according to Grundy (2006):

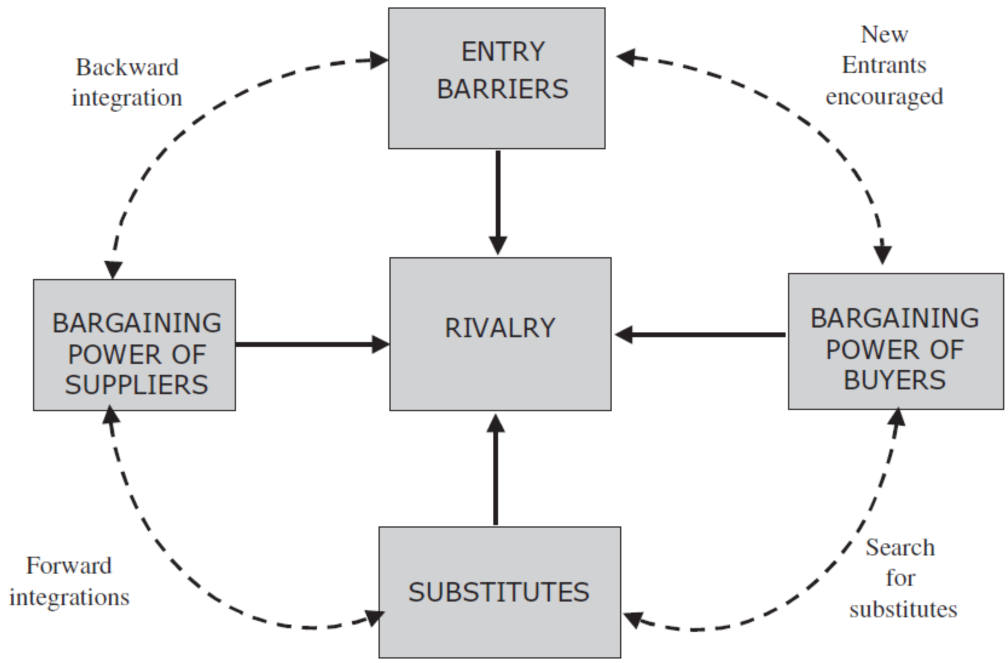

Figure 3: Porter's five competitive forces - key internal interdependencies
Source: Grundy, 2006

An example of an interdependency between "entry barriers" and "bargaining power of suppliers" is that through backward integration new competitors attempt to enter the market. All the interactions depicted in the model are not acknowledged by the traditional model of Porter. Porter depicts industry competitiveness as a result of the five influencing factors but does not incorporate interdependencies between the factors. Furthermore, Porter's Five Forces framework neglects the relationship with the PESTLE analysis. Thus, the approach of Petersen et al. (2017) does not consider a dynamic relationship between the two models, even though it is likely that every industry is affected by the macro environment and vice versa.

The above-mentioned argumentation can also be applied to Tesla. Tesla's unique business model cannot be classified within a certain industry boundary. This is a fundamental difference compared to mature companies, where in most cases companies can be classified in a certain industry. At a first glance, Tesla appears to be a purely automotive company, but in a closer view Tesla can also be classified as a technological company. CleanTechnica, the largest informative website for a renewable future worldwide, illustrates the ambiguity regarding Tesla's company classification, since software is at the core of Tesla's unique infotainment system and autonomous driving features (Crider, 2020). The development of Tesla is similar to a software company, or as Shipley (2020) states: “Tesla builds cars by developing software on unique hardware, much in the way Apple develops the iPhone or Microsoft leverages Intel chips and Dell PCs.” This allows them to constantly improve the software in all cars. For instance, customers requested a function where the steering wheel rises, and the seats are lowered when the car is turned off. Within one-week Tesla was able to offer this function (Valentin, 2019).

Tesla’s approach is to a large extent contradictory to traditional automotive manufacturers. Whereas at Tesla software developers are in charge of the development of the cars, in established car manufacturing companies’ engineers are still mostly responsible for development. Furthermore, Tesla’s products - like solar panels, batteries and charging stations - are largely based on Tesla’s software developments (Furr & Dyer, 2020; Shirpley, 2020). Contrary to the view that Tesla should be classified as a technological company, other views regard Tesla to be more of a car manufacturing company since its main business is the construction and development of cars. These views are supported by the fact that most of Tesla’s revenue is generated by the automotive division (Bernal, 2020).

The above-mentioned explanation regarding Tesla's products and its debatable industry classification shows Tesla’s business model. Instead of being in a clearly defined industry like the automotive industry, Tesla’s business model is built upon a product-based network of connected cars and houses, which are platforms for sharing energy and services. They compete with the traditional car companies, ride sharing companies like Uber and Lyft and energy companies. This product-based network interacts over several interfaces with the outside world and a simple classification in the automotive industry, as Porter's Five Forces assumes it, fails to describe Tesla’s reality (Valentin, 2019).

In addition, other interdependencies between the different forces are existent. If consumers will develop a stronger desire for autonomous driving and robotaxis, the likelihood of new entrants like Alphabet or Amazon is imaginable. Moreover, it can be presumed that the bargaining power of buyers will increase if there is an increasing number of substitutes like better public transport or e-scooters. The absence of consideration of interdependencies in Porter's Five Forces analysis, neglects a large part of the dynamics of the industry. In addition, the criticism outlined in the beginning of this section about not considering the interdependencies between the PESTLE analysis and Porter's Five Forces applies to Tesla. It can be assumed with a high probability that the sociological change towards sustainable mobility or the political approval for autonomous driving will lead to new entrants into the market. Using both the analytical tools only independently of each other misses the recognition of the linkage between the different strategic value drivers, leading to an incomplete analysis of the current and future company situation. The identification of value drivers for Tesla is a complex process that is subject to great uncertainty. The assumptions regarding an industry to be mainly static and the future market changes to be highly predictable have to be questioned. It is much more likely that the PESTLE analysis and Porter's analysis are not entirely suitable for high-growth companies like Tesla.

6.1.3. Value Chain Analysis

In the theory section, the value chain analysis and the modified adapted value chain analysis have been introduced. As the PESTLE analysis and Porter's Five Forces analysis are used as primarily qualitative analyses, the adapted value chain analysis is now analysed as it is more quantitative than the normal value chain analysis. Tesla's value chain is probably one of the most unique value chains within the car manufacturing industry. In the value chain analysis, the analyst examines all activities along the value chain to determine cost behaviour and potential sources of differentiation from competitors. Porter (1998) describes the basis for any strategy by saying that "creating value for buyers that exceeds the cost of doing so is the goal of any generic strategy". Especially start-ups and high-growth companies pursue the objective of achieving high market share instead of high margins (Gnanasambandam, Miller and Sprague, 2017). Even though Tesla adds value for their customers by selling unique products, they are still not profitable because of insufficient margins (Annual Report, 2019). The following section analyses three key problems of using the adapted value chain analysis for Tesla.

Firstly, Tesla's value chain is characterized by a high degree of vertical integration. Whereas the traditional car manufacturer assembly line is built on a high proportion of outsourcing of the various production steps to suppliers, Tesla produces over 80% of their components themselves. For example, the batteries for their cars, which are crucial components for the electric car, are produced in their own production facilities (Valentin, 2019). Additionally, Tesla manages the entire sales process through its own website, unlike traditional car manufacturers who generally outsource the sale of their cars to car dealers (Eckl-Dorna, 2018). If one wants to analyse the entire value chain of Tesla, it is necessary to compare it with the combined value chain of suppliers, car manufacturers and car sellers. Of particular interest are production steps that Tesla conducts on its own, whereas traditional car manufacturers outsource them to suppliers or service providers. At Tesla, the costs for these production steps are generally divided into the cost categories COGS, SG&A, R&D and D&A. For established manufacturers, all the costs related to these outsourced production steps are allocated to COGS without a partial allocation to SG&A, R&D or D&A costs. This leads to a different distribution of total costs between Tesla and traditional car manufacturers. As a result, Tesla would report significantly lower COGS than comparable companies, but would have higher SG&A, R&D and D&A costs.

Secondly, Tesla currently operates in two different business segments, automotive and energy, which will potentially even further increase due to the launch of new products in the future. Current and future business segments need their own value chain as they are difficult to map into one (Hergert and Morris, 1989). The manufacturing of the cars, Tesla's ride-sharing network and the energy related products are difficult to combine into one value chain. Each business segment has different competitors with different cost structures and margins. For an in-depth analysis, Tesla's cost structure including SG&A and R&D has to be allocated to the different segments. Only through an accurate allocation of costs, it is possible to carry out a real evaluation of the individual segments with comparable companies and thus identify competitive advantages. Furthermore, analysts are faced with the problem that internal accounting data are usually not publicly available (Hergert and Morris, 1989). Even if an accurate allocation would be possible and the data would be available, there are still no competitors similar enough especially for Tesla's automotive segment, as Tesla is not comparable to other automotive companies. A comparison of the margins of an electric car manufacturer and a combustion engines manufacturer can only be an indicator for cost structure. Especially the engine of an electric car consists of different components than a combustion engine leading to different production costs (Brennan and Barder, 2016). Because of the inability to compare the key production costs, the competitive advantage cannot be identified in a proper way.

Thirdly, the value chain analysis should benchmark the current margins of the observed company against the current margins of its competitors (Petersen et al., 2017). According to the definition of a McKinsey study, Tesla can be defined as a sustainable supergrower. In contrast to Tesla, most other car manufacturers are defined as cash generators (Gnanasambandam, Miller and Sprague, 2017). Even though Tesla is on its way to achieve sustainable earnings, the margins are still not as profitable as those of their competitors (Annual Report, 2019; Thomson One, 2020).

Whereas margins from traditional car manufactures are of a similar nature, Tesla's margins are significantly smaller even though indicating a positive trend. Hence, the simple comparison of Tesla's cost figures to those of its competitors would be biased due to the different life cycle stages. In addition, whether Tesla's new vertical production approach will be superior to the traditional production approach is difficult to predict, since the vertical production approach has not been used in the car manufacturing industry for decades (Jacobides and MacDuffie, 2013).

The identified problems can also occur simultaneously. This can be explained by using the example of Tesla's battery production. At present, Tesla produces its batteries in their Gigafactory, while other car manufacturers outsource their battery production to suppliers such as Bosch (Cohen, 2020). Thus, for a reliable comparison of the production process, the value chain of the battery supplier and that of the car manufacturer have to be considered as one combined value chain. Even if this combined view would be feasible, precise cost allocation data, especially that of the supplier, must be available for a specific allocation of these costs into the cost categories on the level of the traditional car manufacturer. Currently, it can be assumed that Tesla still has a cost advantage in battery production due to their first mover advantage, since the comparison of battery costs does not permit any reliable results at the present time.

Generally, the adapted value chain is a solid analysis tool for the comparison of different companies within an industry, but not for companies with a unique business model that overlaps multiple industries. The most critical condition to conduct an adapted value chain analysis is data availability, since no comparison is possible without it. If there are enough data available even fundamental problems like vertical/horizontal integration or different life cycles can be taken into account.

As demonstrated in the above analysis, the PESTLE analysis, Porter's Five Forces, as well as the value chain analysis and the adapted value chain analysis have several limitations and problems. Nevertheless, the macro environment, the industry and the company itself must be analysed in depth as part of the company valuation process. Since no other tools exist that can analyse the external and internal environment better as the ones considered in this thesis, they are still the preferred tools to analyse the macro-environment, the industrial environment and the value creation processes in the company. Especially for high-growth companies, an analyst has to acknowledge that the future is dynamic and uncertain and probably no other tool can properly deal with it. However, to improve the application of these analysis tools, they need to be adapted to the changing environment in order to mitigate the above-mentioned problems. Therefore, several points need to be considered when performing these analyses to have a solid foundation for the transformation of strategic value drivers into financials, which is the second step in the DCF model of Petersen et al. (2017) model.

It is important to understand and consider the interrelationships between each analysis tool. It is important to know how the individual factors within each analysis tool influence each other and what impact this has on the business model. It is also important to consider the interdependencies between the analysis tools. As the macro environment, the industrial environment and the value-adding processes of the company influence each other, this has to be taken into account in the external as well as the internal analysis. Furthermore, potential interdependencies within the model have to be considered. As already stated above, the different elements of both the PESTLE Analysis as well as Porter's Analysis are influencing each other. These mutual influences should also be considered while conducting a strategic value driver analysis. In addition, it is important to move away from the thinking of traditional industries, as it has been the case in the past. Today, the different industries are much more blurred. This makes it more difficult to identify similar competitors both for Porter's five-force analysis and for the adapted value chain analysis. As it is difficult to solve this problem, the only potential solution to mitigate it is a broader industry perspective. As an example, a wider industry perspective applicable to Tesla would be to think in terms of mobility instead of only automotive. With these improvements it is still not possible to predict the future exactly, but one understands better what possible scenarios might occur and how different things can affect the external and internal environment of the company.

6.2. Preparation of Pro Forma Statements

After having discussed the problems that occur in the external and internal analysis of Tesla, the process of preparing the pro forma statements is analysed in the following section. According to Petersen et al. (2017), the pro forma statements are forecasted by combining the strategic value drivers and the historical financial statements. Petersen et al. (2017) state: “Together, the strategic analysis and the financial statement analysis serve as efficient means to generate reliable estimates.” Next to Petersen et al. (2017), other researchers share their point of view of estimating the future based on past trends. Rubak (2010) says: “Cash flow forecasts are commonly created by extending income and cash flow statements into the future using historical results as a benchmark”. As already mentioned, the sales-based approach is used. As claimed by Petersen et al. (2017), this approach indicates a better linkage between the company's activities and the related costs. Thus, an accurate forecast of sales plays a critical role, since all further line-items of the pro forma statement are dependent on it (Koller et al., 2010).

As outlined in the theoretical part of this study, the historical financials form a solid foundation for the determination of the pro forma statements. The analysis of the financial statements serves as a basis for the identification of historical levels and trends in key financial value drivers. Petersen et al. (2017) describe it as “a useful starting point when developing reliable estimates of a company's earnings capacity” (Petersen et al. 2017, p. 267). The first step in the forecasting process is estimating the sales. Historical sales figures and the historical annual growth rate serve as indicators for future sales figures and its growth rate. Generally, a positive trend in Tesla’s sales can be observed, although the various annual growth rates have fluctuated widely. In the last five years, Tesla’s sales growth rate has been 57% per year on average, while the rate has fluctuated between 15% and 83%. Due to the high degree of fluctuation in the past financials, they are not a solid foundation for future sales predictions (Damodaran, 2020). However, Petersen et al. (2017) claim: “After no more than three or four years, sales growth converges towards a long-term average value” (Petersen et al., 2017, p.198). According to this statement, Tesla’s growth rate would fall to a value between two and four percent within the next years. In contrast to this line of reasoning, other researchers and analysts are not in line with the assumption of Petersen et al. (2017). For instance, Damodaran (2020) uses an annual growth rate of 25% for the next five years in his Tesla valuation model. Additionally, he assumes that Tesla achieves a growth rate of 4% or less not until year ten. In their report, analysts from Barclays (2020) predict an annual growth rate of 15% for the following three years. This suggests that the assumption of Petersen et al. (2017) is not applicable for high-growth companies like Tesla, as Tesla probably will not reach a steady growth rate between two and four percent since it can be assumed that in the next years Tesla grows stronger than the overall economy.

Next to historical financials, future value drivers have a large impact on future growth rates. If the historical financials are not a solid foundation for the forecast of the sales, the strategic value drivers play an even more important role. Especially for high-growth companies with high sales growth and many future market opportunities the impact of these future strategic value drivers is even larger. Tesla is planning to grow towards a broader and more diversified product range. As it has been described earlier in the company description these new products include the Tesla Roadster, the Tesla Semi, the Cybertruck and the ride-hailing network. All of these future products are strategic value drivers, impacting the future sales generation. To illustrate, the new Tesla Semi will become the first electrified truck. For products that are newly introduced to the market such as the Tesla Semi, analysts do not know how it will be received by the market and how future sales figures will develop. The same applies to autonomous driving, for which the analyst is not yet able to estimate the sales potential. Hence, it is crucial to interpret the strategic value drivers and transform them into financial ones. While doing so, the fundamental problem is that strategic value drivers are qualitative statements that must be converted into quantitative figures. This is one of the most important processes in the forecasting process since the sales are the starting point for the pro forma statements and since they have the highest influence on future cash flows (Koller, 2010). The outcome of the entire valuation is highly dependent on a realistic transformation of the strategic value drivers. Although this is one of the most important parts of the valuation process, there are no standard guidelines that can be followed to successfully carry out the transformation.

As the sales-based approach is used, the majority of line items in the income statement and the balance sheet will be estimated as a direct percentage of sales. Petersen et al. (2017) suggest the use of historical percentages of the past financial statements in combination with past developments and trends to predict each line item. However, Damodaran (2018) states that this approach is not applicable to high-growth companies, as the correlations between past and future financials are usually weak for high-growth companies. Petersen et al. (2017) additionally recommend using the average percentage of comparable companies.

When these approaches are applied to forecast Tesla's income statement, the COGS and SG&A show a clear trend. The COGS rate has increased from 66.7% in 2015 to 74.7% in 2019. Even though the COGS rate has not been stable over the past five years, the trend of Tesla's COGS is similar to that of its peer group, which has an average COGS rate of 74%. Tesla's SG&A cost rate has decreased between 2015 to 2019 from 40.5% to 16.2%. Although Tesla has not reached a stable SG&A cost rate, the rate converged to the level of its peer group which showed an average of 12%. Thus, we can assume that these numbers are realistic and applicable. The reason why Tesla's margins are already similar to those of its mature competitors is that Tesla is not a young high-growth company anymore as it has been in the market for more than fifteen years. The cost figures of Tesla indicate that referring only to the past is not leading to realistic results for high-growth companies. Instead, it is much more important to examine the peer group cost structures and determine whether the company's cost structure indicates either a trend towards that of its peer groups or whether it is already similar to these structures. However, it should be noted that Tesla uses a different production method than its competitors due to the vertical integration of many production steps. Consequently, the cost structure in comparison to its competitors may also change and the cost structure that is currently comparable might not be comparable anymore in the long term.

Petersen et al. (2017) recommend the same forecasting approach for non-current assets and working capital, thus stating that they should grow proportionally with sales. For Tesla, non-current assets as a percentage of sales have fluctuated within the last five years between 90.4% and 234.3%, while a decreasing trend can be observed. Comparing the numbers to Tesla's peer group indicates that the numbers are not in line. The amount of non-current assets as a percentage of sales has been 120.0% in 2019 for the peer group in contrast to 90.4% for Tesla. Based on Tesla's annual report, the working capital fluctuated between (9.3%) and 5.8%, while no clear trend can be observed. As opposed to Tesla, its peer group has had a stable and positive working capital during the previous years. Consequently, Tesla's working capital can neither be calculated based on historical values and developments nor based on peer group companies. As Tesla's capital structure is analysed further on in this study, including its NIBL, it is not analysed at this point.

New approaches to forecasting

The previous section analysed the obstacles regarding the transformation of strategic value drivers into free cash flows. The main issue in the free cash flows forecast is that only one future scenario is assumed (Koller et al., 2010). As Tesla operates in an uncertain and dynamic environment with their current and future products placed on various markets, there are many possible future scenarios imaginable. That is why this study will discuss two other methods to transform strategic value drivers into free cash flows. Instead of determining solely one outcome, the two models attempt to incorporate possible outcomes for different scenarios. This chapter first introduces the scenario analysis and discusses the Monte Carlo Simulation afterwards (Damodaran, 2019). Hereby, advantages and disadvantages are discussed as well as the potential applicability to Tesla.

Scenario Analysis

Within the framework of scenario analysis, outcomes are calculated using various scenarios either by analysing a best/worst case scenario or by conducting a multiple scenario analysis. Both scenarios provide a better way of dealing with uncertainty because they present different scenarios for the future. The best/worst case scenario is the most extreme version of scenario analysis. In the best-case scenario, all input factors are determined for the best, whereas in the worst-case scenario all input factors are set for the worst. To further illustrate, the best-case scenario considers the highest possible revenue growth and operating margin, while applying the lowest possible level of reinvestments (Damodaran, 2018). The difference between the best and the worst-case scenario provides the analyst with a measure of risk. The wider the range between both scenarios, the higher the risk. Since the best/worst case scenario analysis neglects the relationship between the different factors, the approach presents an unrealistic view about the future. A simultaneous maximization of the sales and the profit margin in combination with the lowest level of investments, as foreseen in the best-case scenario, is highly unlikely to be obtained by any company. Therefore, the best and worst case can only be considered as a very rough indicator. However, since the range between the best and the worst case is very wide, it is of little relevance as a useful indicator for the precise determination of a fair enterprise value. (Damodaran, 2018).

For solving the problem, the second type of scenario analysis extends the number of possible scenarios due to the variation of the assumptions regarding macroeconomics and asset-specific variables. Damodaran (2018) describes four critical factors for the successful application of a scenario analysis. These are as follows:

- Deciding which factors, the scenarios will be built around
- Determining how many scenarios to analyse for each factor
- Estimating asset cash flows under each scenario
- Assigning probabilities to each scenario

Transferring this approach to Tesla, in the first step critical factors for Tesla's future have to be chosen, which are for example the behaviour of authorities regarding autonomous driving, electric car incentive schemes and the development of other electric cars by competitors. Afterwards, different scenarios for each factor have to be developed, for instance, the regulatory approval regarding autonomous driving for Tesla’s main markets. During this process, the analyst has to choose between a large number of scenarios that reflect a more accurate view of reality and the additional effort needed in order to create these scenarios. Additionally, it is crucial that enough information is available to set up the different scenarios. All possible combinations of factors and their potential outcomes are considered in order to calculate the various possible scenarios. For instance, combining three critical factors with three possible outcomes are leading to $3^3 = 27$ possible scenarios. In the third step, the cash flows are calculated for each scenario. To simplify the calculation, only two or three critical variables such as growth of the profit margin or reinvestment level are changed between the different scenarios. Finally, the analyst estimates the probability for each scenario. After conducting all four steps, the different outcomes of each scenario are multiplied with their probability and are added together to calculate the expected value of the future cash flows to the firm (Damodaran, 2018).

Multiple scenario analysis enables the analyst to assume a wider range of possible scenarios, however, there are still several problems that need to be considered. First of all, just three critical factors with three outcomes each are already resulting in 27 different scenarios leading to a high degree of complexity. Even though 27 scenarios amount to a high number of outcomes, this amount cannot cover the entire complexity of Tesla's business. Both the nature of Tesla's current and future products and the rapidly growing and changing market environment cannot be forecasted based on only three critical factors, constituting three possible outcomes each. Even if 27 scenarios seem to be a high number of potential scenarios, this amount is only based on three critical factors. However, as the company description and the strategic analysis has outlined, Tesla is a complex company in a highly dynamic market which cannot be depicted with three factors. All in all, scenario analysis is more applicable to businesses that are facing discrete risk instead of continuous risk. For instance, the cash flows of a young pharmaceutical company are often subject to a discrete type of risk, since they are highly dependent on regulatory approvals, while Tesla's future cash flows are more of a continuous nature due to the presence of a combination of multiple uncertain factors, such as new entrants, new products and regulatory approval. Therefore, scenario analyses are not the best possible solution for Tesla's business model.

Monte Carlo Simulation

As has been shown in the previous section, the forecasting process needs to solve the challenge of multiple input variables which are subject to great uncertainty. This problem especially arises in Tesla’s free cash flow to firm forecast. The different possible combinations of current and future products are leading to a wide range of potential future free cash flow to firm growth rates. Therefore, this section introduces a new approach for remedying the problem of uncertainty, which is the Monte Carlo Simulation. The chapter is built up in two parts. Firstly, the probability distributions and Monte Carlo Simulation are introduced. It will be explained why the Monte Carlo Simulation is able to deal with Tesla‘s uncertainty and an outline will be given of the steps to conduct a Monte Carlo Simulation. In the second part the model is applied to Tesla. It is explained how the Monte Carlo Simulation must be adapted to Tesla and how it is integrated to further improve the DCF model.

In general, probability distributions can be classified into discrete and continuous distributions. Unlike the continuous distributions, the probability distributions within the discrete category only have a limited number of possible outcomes. In contrast to the discrete distribution, a continuous distribution can take on any potential value within the range of its interval. Thus, a continuously distributed random variable has an unlimited number of possible values within its fixed interval. Almost all input variables in financial models relate to the inflow and outflow of money. Since real money is only divisible into a limited number of values, it can be classified as a discrete variable. However, due to the high number of possible outcomes, this approach is rarely used in practice. Instead, it is more common to use a continuous distribution to represent the discrete variables (Vose, 2000; DeFusco et al., 2001).

The Monte Carlo method is a widely used approach to solve mathematical problems that lack an analytical solution due to their complexity. Within the framework of scenario analysis, only discrete variables can be used to model the outcome. The Monte Carlo Simulation offers the analyst an approach to tackle the problem of a wide range of different outcomes using continuous variables. The method is mostly used in the financial industry. Using the statistical probability distribution of all potential outcomes an absolute numerical value, usually the average value, can be calculated (Vose, 2000). The input variables within the simulation are presented as probability distributions. When the Monte Carlo Simulation is used, the continuously distributed input variables are randomly combined to calculate the outcome of a specific scenario. This process is then repeated as often as required. When the required quantity of simulations is achieved, a list of all outcomes which were calculated in the simulation and the frequency with which they occur is displayed. Based on the total number of simulations and the absolute frequency with which each event occurs, a probability distribution can be formed (Fishman, 1995; Hubbard, 2010).

Integrating the Monte Carlo Simulation into the DCF Model

When the Monte Carlo Simulation process is used within the DCF model, the model must be modified for the simulation process. Although it is based on the standard DCF model, the simulation differs from the DCF model in one key aspect. Instead of taking the input variables as fixed values, they are entered into the model as a probability distribution. For all the input probabilities, the analyst has to choose the appropriate type of probability distribution and the correct distribution parameters (Damodaran, 2009). In contrast to the regular DCF valuation model, the inclusion of Monte Carlo Simulation in the model requires that some, or even all, fixed values for the input variables are replaced by probability distributions (Smith, 1994). The prediction of input variables and their distribution functions is based on historical data, comparable companies and on the personal expertise of industry experts and analysts. These different sources of information are usually combined in the identification of strategic value drivers using PESTLE analysis, Porter's Five Forces analysis and value chain analysis. Hence, it is required to conduct the strategic value driver identification as a basis for the Monte Carlo Simulation (Kelliher & Mahoney, 2000; Brealey, et al., 2011; Titman & Martin, 2011; Rozycki, 2011). Since the process of identifying and defining probability distributions is very complex, it is important to consider only those variables of the model that have a large influence on the valuation, and for which it is complicated to determine an exact value. The impact of a variable on the intrinsic enterprise value can be calculated using the sensitivity analysis. All other variables that do not have a large impact on the valuation or those variables that can be predicted with great certainty are set as a fixed value (Smith, 1994; Tamošiūnien & Petravičius, 2006).

The underlying concept behind the Monte Carlo Simulation is grounded in the probability of the occurrence of events. Therefore, probability theory is the basic theory behind the Monte Carlo Simulation. Firstly, the choice of the probability distribution type for a variable is important. In this study three types of distributions are presented: the uniform distribution, the normal distribution and the log-normal distribution. The selection of these three specific distribution types was made based on applications in the context of DCF valuation. As each distribution type has different characteristics, the selection of the different distribution types for the variables are based on the strategic analysis of the company.

Uniform distribution

The uniform distribution assumes a constant probability density. To define a uniform distribution, only a minimum and a maximum value which the variable can take have to be determined. As an example, 40 for a minimum value and 60 for a maximum value. The uniform distribution only allows values within the defined range. All values within this range have an equal probability of occurrence, which means that no variable value is more or less likely than the others (DeFusco et al., 2001).

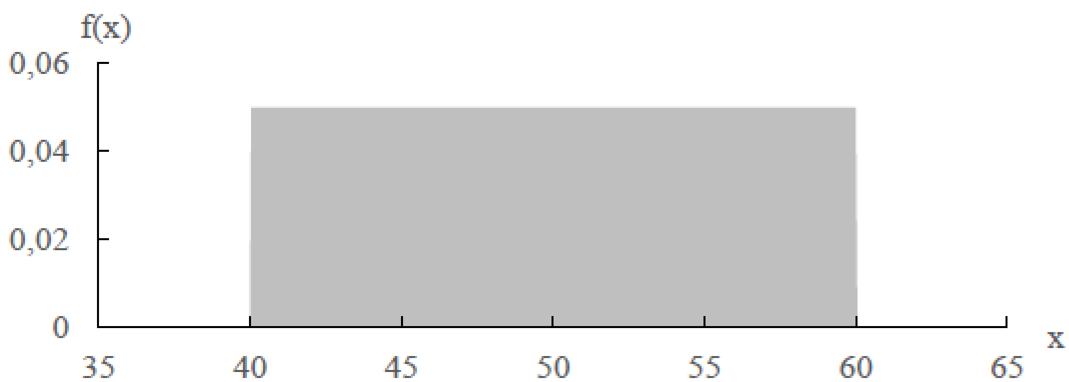

Figure 4: Uniform distribution
Source: Own Creation

Normal distribution

The normal distribution is determined by its mean and standard deviation. It is symmetrical around the mean, which means that the probabilities of normally distributed variables that take values below or above the mean are equal. The probability of the occurrence of certain values decreases when the value is further away from the mean. Since many random variables tend to be normally distributed, this probability distribution is highly relevant for many cases (DeFusco, et al., 2001).

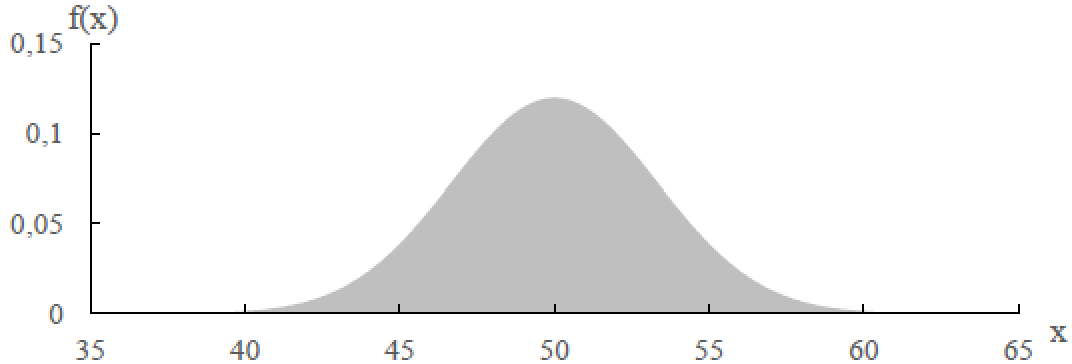

Figure 5: Normal distribution
Source: Own Creation

Log-normal distribution

The log-normal distribution is a continuous probability distribution for a variable that can only take on positive values. It describes the distribution of a random variable if the random variable, transformed with the logarithm, is normally distributed. A logarithmically normally distributed random variable is created by the product of many positive random variables. This makes the logarithmically normally distributed random variable the simplest distribution type for multiplicative random processes. Multiplicative laws play a greater role in the natural sciences, economics and technology than additive laws, and the logarithmically normal distributed random variable is highly applicable in growth processes. (DeFusco, et al., 2001)

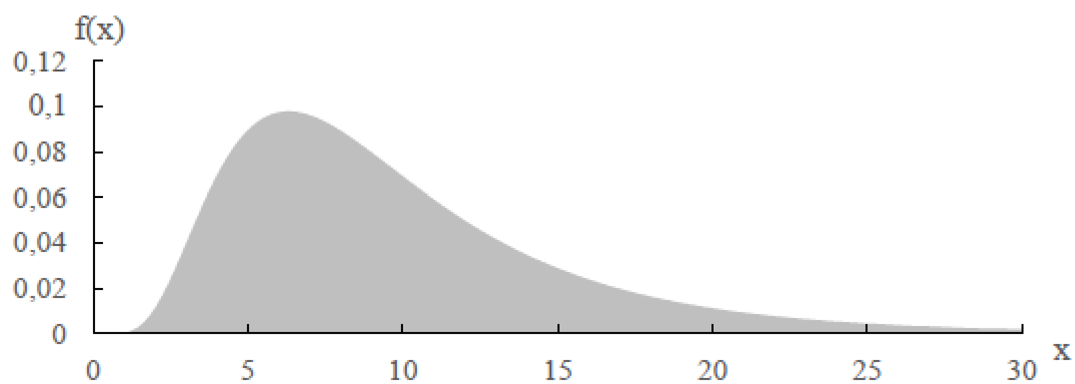

Figure 6: Log-normal distribution
Source: Own Creation

Correlations

It often occurs that input variables correlate with each other. This means that different input variables cannot be drawn independently. This phenomenon must be taken into consideration. These interrelationships between input variables have to be integrated into the Monte Carlo Simulation, however, estimating the correlation effects between input variables is difficult (Brealey, et al., 2011). To solve this problem, the literature recommends using available knowledge and expertise as well as historical data. (Kelliher & Mahoney, 2000). Within the framework of the Monte Carlo Simulation, the number of iterations depends on the number of input variables and the degree of correlation between them. A larger number of input variables and higher correlation between these variables will require a higher number of iterations.

When the simulation procedure is started, a random value is drawn from each predefined input variable probability distribution. Subsequently, the model calculates the corresponding outputs. After calculating the outputs, the output values are saved for the usage in the output statistics. This procedure is repeated until the number of completed iterations corresponds to the number of required simulations. Using the outcomes of the iteration process, statistics about the simulated case can be created. For example, the minimum and maximum value, mean and standard deviation can be determined. Next to the descriptive statistics, the outcomes can be used to define a probability distribution, probabilities of occurrence of different values and graphical representations of the distribution (Brealey, et al., 2011; Kelliher & Mahoney, 2000).

Basically, the Monte Carlo Simulation is used by practitioners like Damodaran (2020) to calculate the intrinsic enterprise value by incorporating sales, operating margin, tax rate, reinvestments and also the discount factor. Since the basic structure of the DCF model should remain unchanged, the Monte Carlo Simulation is in this case used to calculate only the free cash flow to firm. Hence, in this study just the components sales, operating margin, taxes and reinvestment are discussed. Since the discount factor can be forecasted based on proven models, it is not discussed as part of the Monte Carlo Simulation. A detailed explanation of the discount factor and the theories behind it is given in the later course of this study.

The free cash flow to firm is based on variables that can take on many different values and are strongly correlated with each other. Thus, the free cash flow to firm of Tesla has a wide range of different possible outcomes. To deal with this uncertainty, the Monte Carlo Simulation is able to solve this problem with stochastic simulations. In the following, the best possible probability distribution for each cash flow driver is outlined and potential interrelationships between these drivers are explained.

The log normal distribution best represents the future possible sales growth opportunities. This is firstly because Tesla will probably not experience negative growth in the coming forecast years. In addition, through a solid position in the electric car market, a stable growth in the low percentage range is likely. Due to future products like the Tesla Semi and the Ride-Hailing app and the fact that Tesla is a pioneer in the field of autonomous driving, there is also a possibility that Tesla will be able to achieve very high-growth rates in the future, just like it has done in recent years. However, the likelihood of these high-growth rates is quite low as it becomes more and more difficult for Tesla to achieve them. This is partly because the level of competition is increasing for Tesla and partly because it is generally more difficult for large companies to achieve high-growth rates than for smaller companies.

The operating margin is influenced by COGS and SG&A expenses. Even small changes in the operating margin have a major impact on the value of the company. In addition, there is a correlation between sales and operating margin as the cost structure is significantly influenced by the sales growth. Hence, it is difficult to determine one operating margin. It is not possible to predict the impact of the Tesla Semi or the new Tesla Roadster on Tesla's cost structure. If Tesla would become a mass market manufacturer, costs will probably account for a much larger share of total sales than if Tesla would focus on products in the premium segment. To realistically represent these uncertainties and correlations with sales, it is therefore necessary to approximate the cost structure using Monte Carlo Simulation. In contrast to sales, we assume a normal distribution for the cost structure. Since Tesla is a manufacturing company, it cannot benefit from economies of scale to the same extent as technology companies like Facebook or Google. Hence, we believe that the chance of increasing the operating margin is equal to the chance of reducing it.

For Tesla's tax rate, a normal distribution should be used in the Monte Carlo Simulation. As Tesla's main markets are predictable in the forecast period, a range regarding the tax rate can be assumed. Of course, taxes can vary slightly from year to year, but they will fluctuate only slightly around an average value.

Tesla's reinvestments are highly predictable and thus, a normal distribution can be used within the Monte Carlo Simulation. Since Tesla has already reached a relatively stable level of investments in recent years, it can be assumed that this will continue in the future. However, small increases or decreases are possible and equally likely. Thus, a normal distribution is the most meaningful distribution type.

As mentioned before, besides the types of probability distribution and ranges, it is important to determine the correlation between the variables. The correlations between the various input variables are determined based on historical data and experience. For Tesla sales, operating margin, taxes and reinvestments are highly correlated in a way, that a very high-growth in sales cannot be accompanied by a high improvement in the operating margin or high-growth in long-term sales cannot be achieved with low reinvestments. This correlation and the influence of the variables among each other must be included in the model to obtain correct outcomes.

The preceding analysis shows how the forecasting in the DCF model can be further improved by use of the Monte Carlo Simulation. Furthermore, the analysis demonstrates that especially in dynamic companies like Tesla, the Monte Carlo Simulation is significantly better than the scenario analysis due to its descriptive components. Since Monte Carlo Simulation can combine many possible variables with different probability distributions, this results in a significantly wider range of possible outcomes than it would be the case with the transformation of strategic value drivers into financial value drivers using standard DCF models. Nevertheless, assumptions still have to be made, since both the distributions of the individual variables and their correlations must be determined by the analyst. For this, the identification of the strategic value driver is of great importance.

6.3. DCF Valuation Model

6.3.1. Technical Aspects

The preceding section examined the transformation of strategic value driver into financial forecasts and the free cash flow to firm. In the following paragraph the technical steps of the DCF model are analysed. This chapter begins by looking into the length of the forecasting horizon in combination with potential approaches to calculate the terminal value. As a second step the discount factor is analysed, in particular the weighted average cost of capital (WACC) including all of its underlying variables.

6.3.2. Time Horizon

The literature generally states that the length of the forecast horizon should not have an impact on the intrinsic enterprise value and that it only affects the distribution of the total "company's value between the explicit forecast period and the years that follow" (Koller et al., 2010, p. 218). However, by expanding the length of the forecast period an increasing amount of future strategic value drivers can be considered, leading to a more precise valuation (Damodaran, 2018). The extended forecast period increases the accuracy of the forecast model and the process of developing longer forecasts encourages the analyst to look deeper into the company, its business model and its relevant market environment. Therefore, there is a considerable amount of literature that discusses this topic. The questions asking what the right forecast period length is and what are the right approaches to determine the relevant terminal value are still missing a definite answer.

In the literature there is a consensus about the length of the forecast period. Petersen et al. (2017), Damodaran (2018) and Koller et al. (2010) state, that the forecast period should last until the company reaches a steady growth. However, the predicted period of time until a steady growth is reached, differs significantly between companies. Petersen et al. (2017) claim that "after no more than three or four years, sales growth converges towards a long-term average value" (Petersen et al., 2017, p. 198). Damodaran (2018) and Koller et al. (2010) endorse a greater variability regarding the length of the forecast period. For instance, Koller et al. (2010) recommend "an explicit forecast period of 10 to 15 years - perhaps longer for cyclical companies or those experiencing very rapid growth" (Koller et al., 2010, p. 188).

The missing consideration of company specific characteristics and the company's business life cycle by Petersen et al. (2017) is confirmed by the fact that they assume a small interval to approximate the share of the terminal value from 60% to 80% of the total enterprise value. While this distribution is realistic for mature companies, it is usually not applicable to companies situated in different life cycles. In contrast to Petersen et al. (2017), Koller et al. (2010) provide a broader range for the share of the terminal value, since they take industry development and future business opportunities into account. The three authors illustrate this by using three different companies from various sectors and present their distribution of the total enterprise value between the forecast period cash flows and the terminal value based on an eight-year forecast. In the mature tobacco industry, the terminal value accounts for 56% of the total enterprise value, in the sporting goods industry it accounts for 81% of the total enterprise value, and it accounts for 125% of the total enterprise value in the tech industry. In the case of a tech company, high capital expenditures and working capital investments lead to cumulative negative forecast period cash flows which need to be offset by the terminal value to achieve a positive total enterprise value (Koller et al., 2010).

These different suggestions concerning the length of the forecast period can be transferred to Tesla. A large part of Tesla's future earnings potential is in the distant future. To properly incorporate Tesla's earnings potential, a forecast period longer than five years has to be used. Hence, the short forecast period in the standard DCF model cannot reflect Tesla's future earnings potential accurately. Thus, it is recommended to use a forecast period over ten years. This suggestion is in line with Damodaran's Tesla valuation model (2020) where he applies a ten-year forecast period. Further, the recommendation is confirmed by Tesla's expected negative free cash flow to firm within the next years indicating that Tesla will not reach a steady growth anytime soon (Barclays, 2020; Credit Suisse, 2020; Damodaran, 2020). Since the forecast period should not end until stable growth is reached, a longer forecast period is required.

After having discussed the time horizon of the forecast period, possible approaches to calculate the terminal value will be considered. Petersen et al. (2017) present the DCF model as a two-stage model. The first stage consists of an explicit forecast period and the second stage captures all cash flows after the forecast period. The second stage is a mathematical expression, also called the Gordon Growth Model. Other researchers like Koller et al. (2010) introduce further approaches to calculate the terminal value. They divide them into cash flow and non-cash flow approaches. Non-cash flow-based approaches that are of particular interest to this study are multiples and the liquidation value, while the three-stage model is a useful cash flow-based approach.

Even though the multiple approach is frequently used by analysts, the approach is inconsistent with the general idea of the DCF model. Whereas the DCF model is based on the intrinsic value of the company, the multiple approach uses the market values of peer group companies (Damodaran, 2018). Hence, using a multiple to calculate the terminal value would lead to an inconsistent result of the intrinsic enterprise value, as multiples include potential irrational behaviour of market participants into the valuation (Bearley et al., 2017). Multiples are only acceptable if it is highly probable that the company will be sold at the end of the forecast period.

The liquidation value is the sum in monetary terms of after selling all assets and paying off all liabilities. In the two-stage model, the sum is then set as the terminal value. The liquidation approach is applied, if the going-concern value is lower than the liquidation value or if the going-concern assumption for the company is unlikely after the forecast period (Koller, et al. 2010).

The three-stage model is based on the same idea as the two-stage model, but the terminal period is divided into two stages. This enables the analyst to use different growth rates, free cash flows and discount factors in each stage (Koller et al., 2010). This approach is especially useful for high-growth companies, since the three-stage model can better represent the growth trend of the company. After the forecast horizon, which is similar to the forecast horizon in the two-stage model, a second stage with a constant growth rate higher than the long-term growth rate is applied for a certain period of time without the necessity of calculating the pro forma statements. The third stage is similar to the second stage in the two-stage model, where a continuous and infinitely lasting growth equal to the overall economy growth is assumed.

Combining Tesla's historical growth rates with the strategic analysis, a continuing growth for Tesla can be assumed. This is supported by the findings of technology experts of the Japanese newspaper "Nikkei". The journalists ascertained that Tesla is six years ahead in the field of technology compared to competitors like Volkswagen or Toyota (Kume, 2020). Thus, it can be concluded that Tesla has an ongoing competitive advantage and a growth rate higher than the overall economy in the near future. Combining the previous findings, a three-stage model is recommended to value Tesla in order to include the high future growth rates for Tesla in an efficient and accurate manner.

Another problem regarding valuation using the DCF model is the assumption about an infinite company life. Most terminal value approaches assume that the company exists forever. Numerous companies demonstrate that companies are able to compete for long time periods in the market. For instance, the well-known German car manufacturer Daimler was founded in 1883 and also a Danish brewery founded in the 19th century A.C. still exist (Daimler, 2019; Carlsberg, 2020). The DCF model's outcome does not differ significantly whether a long life or an infinite life for the company is assumed. This problem can be illustrated by a short example.

For the sample company, a constant cash inflow of $50 per year and a weighted average cost of capital of 5.0% are assumed. This results in an intrinsic enterprise value of $1000. During the time period the DCF model was developed, the average S&P 500 company life was about 60 years. By capitalizing all future cash flows until year sixty, we receive $946.46. This accounts for 94.6% of the actual intrinsic enterprise value. Hence, the gap between assuming an infinite lifetime or a life of sixty years is relatively small.

Nowadays, changing market conditions and accelerating innovations have reduced the average life of an S&P 500 company from approximately sixty years in 1958 down to just twenty years in 2012. McKinsey (2016) even estimates a further reduction of companies' lifetime (Borpuzari, 2016; Garelli, 2016). Applying the shorter company lifetime to the example calculation, a value of $623.11 is received by capitalizing all future cash flows until year twenty. This accounts for 62.3% of the actual intrinsic enterprise value (Sheets, 2017).

In the 1960s, the assumption of an infinite lifetime for companies was nearly consistent with reality, since a large amount of the enterprise value could be capitalized during the average company lifetime. Because of a decreasing average lifetime of less than 20 years nowadays, the calculation reveals that the assumption of an endless lifetime is no longer applicable. The changing market conditions need an adaptation of the terminal value calculation. According to Credit Suisse, not every company will go bankrupt after twenty years, but there will be more mergers and acquisitions activities between established companies to combine strengths against disruptors (Sheets, 2017).

After a certain period of time there is the potential of organizational changes through mergers and acquisitions or a discontinuation of business activities and the going concern of the company. Thus, it is recommended to use the scenario analysis to calculate the terminal value. In the first scenario, the company continues its operations and the growth model is used for the valuation. In the second scenario, the company becomes part of a mergers and acquisitions process, where multiples are a good indicator for the price. In the third case, the company discontinues its business activities and the company is worth the liquidation value. A combination of these three scenarios and their outcome in combination with the probability of occurrence is probably leading to the most realistic terminal value. Even if the forecast of the probabilities for each scenario is difficult, solid assumptions can be established due to historical data and expert estimates.

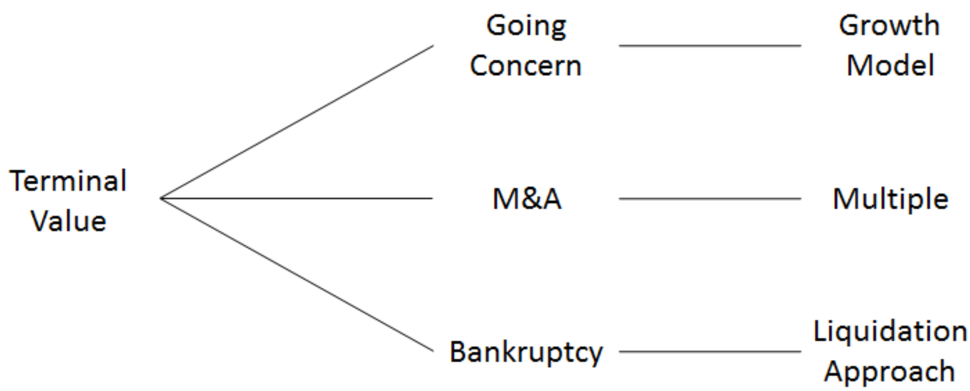

Figure 7: Terminal Value as a combination of different scenarios
Source: Own creation

Taking into consideration the identified problems regarding forecast period, terminal value calculations and assumptions regarding infinite company life, it is recommended to use an adjusted three-stage DCF model to value Tesla. The forecast period should be long enough to capture most of Tesla's near future strategic value drivers. Thus, a general forecast period of at least ten years is needed to cover all potential strategic value drivers included in Tesla's Master Plan two. Additionally, Tesla will probably not reach a steady growth equal to the overall economy after the forecast period. The technological advantage it has over its competitors will give Tesla an edge for years to come, leading to higher growth rates than those of the market. A second stage is necessary, to reflect the competitive advantages for another period of time for Tesla without predicting the pro forma statements. With the help of the three-stage model and the proposed scenario analysis to determine the terminal value, a valuation model that is closer to reality than the standard DCF model can be created.

6.3.3. Discount Rate – WACC

In the following section the discount factor used in the DCF model is analysed. Since the DCF model is used to the entire company, the underlying discount factor is the WACC.

6.3.3.1. Capital Structure

The capital structure indicates the distribution of the enterprise value between the market value of equity and the market value of debt. The fact that that the capital structure is of minor importance within the framework of the standard theoretical DCF model is confirmed by Petersen et al. (2017) who only present a brief thematization of this topic. Koller et al. (2010) acknowledge this with the statement that "although a poorly managed capital structure can lead to financial distress and value destruction, capital structure is not a key value driver" (Koller et al., 2010, p. 524). The capital structure management is therefore not an active driver of the enterprise value, but without a sound capital structure the actual and future strategic value driver cannot be transformed into monetary gains.

Petersen et al. (2017) further elaborate that "only a modest number of firms have a clear policy for their target capital structure" (Petersen et al., 2017, p. 341). However, a study by Graham and Harvey (2001) contradicts this statement. These researchers investigated the capital structure management in companies by asking 392 chief financial officers. They discovered that only 19% of the companies do not follow a target capital structure. To be more precise, 10% follow a very strict target, 34% follow a somewhat tight target/range and 37% follow a flexible range. These observations prove that conscious management of the target capital structure is much more prevalent in companies than Petersen et al. (2017) assert. Therefore, the analyst has to assess the company's current target capital structure as well as its development and the value of equity and debt in order to discover its influence on the valuation.

For listed companies like Tesla, the market value of equity can easily be derived from multiplying the outstanding shares with the share price. In contrast to the equity calculation, the calculation of the market value of debt is way more complex for two reasons. Firstly, the market value of different types of debt like loans, bonds and mezzanine capital has to be summarized into one bond. Secondly, the bond pricing formula consisting of the interest expense (in dollars), the current cost of debt (in percentages) and the weighted average maturity (in years) is very intricate (Schweser, 2018). Therefore, this formula has only limited application in practice. Almost all practitioners use, under the premise that the company has an investment grade rating, the NIBL as an approximation for the market value of debt (Petersen et al., 2017; Vernimmen, Quiry, Dallocchio, Le Fur and Salvi, 2018).

Petersen et al. (2017) only deal with the calculation of the capital structure of privately held companies. As described in the theory section, they recommend applying the capital structure of comparable listed companies in combination with the iterative approach to forecast the capital structure for companies. Both approaches have limitations for various reasons. As Petersen et al. (2017) already mentioned, it is difficult to find companies that have a high level of comparability with the target company. Finding comparable companies regarding company characteristics such as size, profitability or life cycle is difficult. In addition, today's dynamic business environment is leading to industries that are more difficult to separate from each other. Based on these reasons it is difficult to find a sufficiently large peer group of comparable companies. Wald's (1999) study confirms these findings. In his study, the author proves that the capital structure is largely influenced by company characteristics like risk, PP&E, R&D, depreciation as well as size and country specific factors.

The iterative approach seems to be better applicable because more company-specific characteristics are considered. Koller et al. (2010) recommend this approach also for privately held companies since their intrinsic market value can be fairly calculated. Based on the calculated intrinsic market value of equity and the current market value of debt, the current capital structure can be derived. However, since Tesla is a listed company and its shares are traded on the stock market, the market value of equity can be calculated with the number of outstanding shares and the current price per share (Koller et al., 2010). Thus, the iterative process is less useful for listed companies like Tesla. Additionally, comparable companies can only serve as indicators for a potential development of the capital structure.

According to Petersen et al. (2017) the capital structure for listed companies in the DCF model should be based on the actual market value of equity and the actual market value of debt. However, this type of analysis only takes values from fixed reporting dates instead of taking values from a longer time period into account. Hence, fluctuations over time due to price changes of the share or changes in the amount of debt are not considered. Therefore, the capital structure should be observed over a period of time instead of a fixed date (Frielinghaus, Mostert and Firer, 2005). The following table presents the capital structure of Tesla based on the market value of equity and the NIBL as an approximation of the market value of debt over the last five years.

	31.03.2016	31.03.2017	31.03.2018	31.03.2019	31.03.2020
Market capitalisation	81.2%	86.5%	86.4%	87.2%	93.2%
Net Debt	18.8%	13.5%	13.6%	12.8%	6.8%

Table 1: Tesla's capital structure (in %) over time
Source: FactSet

These figures indicate that the equity share in Tesla's capital structure increased slightly over the last five years. The question arises whether this capital structure is also intended for the long term or whether the target capital structure will be adjusted in the future. For the determination of the long-term capital structure several methods are available. Frielinghaus et al. (2015) combined the research field of the company’s capital structure with the research field of the company's life cycle to analyse the changes in the company's capital structure over its lifetime. In the following, different theories and the potential future development of Tesla’s capital structure are discussed.

The general idea behind the management of the capital structure is that the capital structure should be set in a way that the enterprise value is maximized (Schweser, 2018). The main theory regarding capital structure is based on the ideas of Modigliani and Miller (1958). There are also other well-known capital structure theories in the literature - like the pecking order theory introduced by Myers (1984), the agency cost theory by Jensen (1986) and the capital structure life stage theory by Bender and Ward (1993). In the following paragraphs each method is briefly described and analysed whether Tesla, based on actual and historic figures and decisions, will potentially follow one or more of these theories.

Static trade-off theory

The most relevant and well-known approach is the static trade-off theory. Simply stated, the optimal capital structure should be “determined by various trade-offs between the costs and benefits of debt versus equity” (Kayhan and Titman, 2007, p. 1). According to Koller et al. (2010) the key benefit of an increasing leverage is the tax shield. This benefit is offset by the cost of business erosion and bankruptcy. Since Tesla has not generated net income in the last five years, a tax shield should have no influence on Tesla's decisions regarding capital structure. But a crucial factor is Tesla’s potential risk of bankruptcy. Tesla has created a new industry sector going along with enormous business risks. To harmonize the capital structure with the static trade-off theory, Tesla should finance its business largely with equity and only use a small portion of debt. By looking at Tesla's capital structure, it can be assumed that it is possible that Tesla follows the static trade-off theory for setting their target capital structure.

Pecking order theory

The pecking order theory is based on asymmetric information between the management and investors (Myers, 2001). Myers (1984) examined the financing of companies’ projects and found that companies tend to follow a “pecking order”. Companies prefer financing by retained earnings and internal equity, followed by debt and as the last choice the financing by external equity. According to the theory, the management sends signals to the investors with their forms of financing. Internal financing is preferable to debt, as debt is only issued if the company has insufficient internal financing or retained income to finance investment project. This statement is confirmed by a study from French and Fama (1988). In this study they found out that there is an inverted relationship between the leverage and profitability of companies. Furthermore, Myers (2001) states that debt should be preferred over the issuance of new equity. The pecking order theory implies that the issuance of new equity signals the investors that management believes the shares are overvalued.

Looking at Tesla's funding in the last years indicates that Tesla is not following the pecking order theory. As stated in the company description, Tesla is not generating a positive cash flow from its operations and has high financing needs. Since Tesla has not generated a net income in recent years, it does not have sufficient retained earnings to finance its growth plans. Based on the pecking order theory and the interpretation of Frielinghaus et al. (2005) Tesla should finance its growth to a large part with debt. However, the previous financing from Tesla indicates a higher amount of capital was raised by issuing new shares than Tesla received by taking on new loans (ThomsonOne, 2020).

Agency cost theory

The agency cost theory refers to the asymmetric information and conflicts of interest between managers and shareholders. Managers without a high stake in the company are preferring a lower share of debt, as debt always entails financial obligations. Throughout the higher debt ratio managers are less flexible regarding the spending of the free cash flow to firm. Thus, shareholders are pursuing a higher debt ratio to pressure the management to use funds efficiently (Frielinghaus et al., 2015). Forsberg (2004) found out that a larger portion of ownership by the management leads to decreasing agency cost. As a result, the company is financed with a lower debt ratio. The agency cost theory can also be transferred to Tesla's capital structure decision. Elon Musk, the CEO of Tesla, is the largest shareholder of Tesla with 18% of Tesla's total outstanding shares (Thomson One, 2020). As the largest owner and the CEO are the same person, asymmetric information and conflicts of interest between the management and shareholders are quite low. The low agency costs are leading to a lower debt ratio.

Capital structure life stage theory

The capital structure life stage theory connects the changing characteristics of the company during its life cycle to its capital structure. The trade-off between the company's business risk and its financial risk is considered. Due to a decreasing business risk over the company's lifetime, a higher financial risk can be taken (Bender and Ward, 1993). In this light, a start-up or a high-growth company should be financed with a high equity ratio. In contrast, mature companies can be financed with a larger share of debt and use the leverage effect in their financing. Thus, the capital structure life stage theory is applicable to Tesla. As described in the company description Tesla has a high amount of business risk, since a large part of their earning potentials is in the future. According to this reason, Tesla should not take high financial risks. This is supported by Tesla’s low debt ratio.

In the previous analysis, it is demonstrated that the static trade off theory, the agency cost theory and the capital structure life stage theory are feasible capital structure theories that Tesla is pursuing. Petersen et al. (2017) assume only one target capital structure which changes only slightly over time. They describe the differences between capital structures in the various sectors in detail, but do not focus on different capital structures at the stages of the company life cycle. Even though Petersen et al. (2017) do not deal with the changes of the company's capital structure over its lifetime, Frielinghaus et al. (2017) indicate in their study that companies change their capital structure over their lifetime and that proportion of debt increases over the company's life cycle. All three applicable theories for Tesla are confirming these presumptions. As previously stated in the static trade-off theory, there is a trade-off between the tax shield and bankruptcy risk. Over a company’s lifetime it can be assumed that the net income increases and hence the value of the tax shield increases. In contrast to that the business risk and consequently the bankruptcy risk decreases. Thus, it makes sense to have a higher debt ratio, and thereby maximise shareholder value. The agency cost theory assumes increasing agency cost while the free cash flow increases and the share in the company owned by the management decreases. It is expected that Tesla will generate an increasing positive cash flow in the future and that the share of Elon Musk in the company will further decrease through the sale of shares and hence the agency cost increases. In order to reduce the agency cost, a higher proportion of debt should be aimed. According to the capital structure lifetime theory, the overall company risk is a sum out of the business risk and the financial risk. As Tesla is becoming a more mature company over time, the business risk decreases. Consequently, a higher finance risk can be taken, which leads to a higher debt ratio.

In the previous section, the changing capital structure in Tesla’s future development to a higher debt ratio was explained. In the next step, the future debt ratio from Tesla has to be determined.

For this purpose, the method of Petersen et al. (2017) to use the capital structure of comparable mature companies as a reference point is used. Based on the company description, it is assumed that Tesla's closest peer companies are car manufacturers. Thus, the capital structure of six car manufacturers are compared. The capital structure of Tesla's peer group is stated in the following table:

	Tesla Inc.	BMW AG	Daimler AG	General Motors Company	Toyota Motor Corp.	Volkswagen AG
Market capitalisation	93.2%	23.0%	17.5%	21.1%	50.6%	20.7%
Net Debt	6.8%	77.0%	82.5%	78.9%	49.4%	79.3%

Table 2: Capital structure (in %) of selected car manufacturer as of 31/03/2020
Source: FactSet

According to the prior analysis, Tesla's capital structure should adapt to the capital structure of comparable mature companies over time. In consideration of Tesla's great growth opportunities, it is assumed that the mature stage will be reached in 10 years at the earliest and thus, the capital will become equal to their peer companies. This change must be considered into the WACC formula to capture the influences of Tesla's company life cycle on the discount factor. Hence, it can be assumed that the capital structure of Tesla will adjust and the share of the market value of equity will decrease from currently over 90% down to less than 30%, which would be in line with other car manufacturers.

6.3.3.2. Return on Equity

The return on equity has a high influence on the intrinsic value of a company as it is one of the main drivers of the discount factor. Especially for Tesla the return on equity in the WACC formula is important, since Tesla is financed by a large share of equity. The return on equity is based on the risk-free rate, the beta factor and the market risk premium. The risk-free rate and the market risk premium are identical for all companies. Only the beta captures the company's systematic risk, and hence causes the difference between the return on equity of different companies. In the following the problems in the determination of the equity beta are discussed and subsequently, new approaches are analysed.

According to Damodaran (2012) three errors occur in the estimation of the beta. The first problem is the choice of the market portfolio. No market index is able to reflect the entire market. For instance, the S&P 500 is only incorporating 500 companies, however there are many asset classes that need to be incorporated into the market portfolio. Thus, the underlying market portfolio is only incorporating a subset of the whole market which leads to a measurement error. Even though this problem impacts the calculation of the company specific beta, using market indexes like S&P 500 is the best way in terms of the cost-benefit ratio as constructing a market index capturing the entire market with all different asset classes is almost impossible (Damodaran, 2012). The second measurement error is that the CAPM does not give any information about the underlying time period used to determine the beta. Depending on the chosen time period there is a trade-off between more observations in the regression and the change in the characteristic of the company. Basically, it is assumed that a longer observation period leads to a more accurate calculation of the beta. However, for companies which changed their characteristic in terms of business model, the time period should not include points in time before the company has transformed. The third measurement issue of the beta estimation is the choice of the return interval. The historical return of betas can be measured in four time periods, on a daily basis, on a weekly basis, on a monthly basis or on an annual basis. Different chosen time periods are leading to different beta estimations (Damodaran, 2012).

All the estimation errors have in common that they are looking backwards. The historical development of the market portfolio and the historical development of the underlying stock are used to forecast the future systematic risk of the underlying stock. However, as the future of both the market portfolio and the stock can be different to the past, the future systematic risk of the company can differ from its past one. Blume (1975) dealt with the problem that beta is a past-based measure and found out in his study that company's beta tends to adapt towards one. For betas less than one this means that they will increase in the future and for betas higher than one this means that they will decrease in the future.

Since the beta of Tesla is only slightly above 1.1 (FactSet, 2020), the influence of this adjustment is quite small. It is more important to look at the betas of competitors like Daimler, BMW, VW, General Motor or Toyota. Here, it is important to use the unlevered betas, as the different capital structures between the companies lead to different levered betas. Comparing the unlevered beta of Tesla to its competitors it is noticeable that the unlevered betas of these companies are significantly lower than the unlevered beta of Tesla. The values of these companies fluctuate between 0.37 and 0.66 (FactSet, 2020). Since it is assumed that Tesla is similar to these companies in many aspects, it also assumed that the unlevered beta of Tesla will move towards the unlevered beta of its competitors. This development can be supported by a study of Chincarini, Kim and Moneta (2017), dealing with the life cycle of beta.

The study of Chincarini, Kim and Moneta (2017) proves that the beta becomes lower over time. This reduction is on average 0.14 for every 20 years. In their study, they divided the firm's systematic risk into risk based on uncertainty regarding accounting and fundamental factors and risk based on uncertainty not captured by these two factors (Chincarini et al., 2017). While previous studies have already considered accounting and fundamental factors like size, book-to-market ratio and the payout ratio, they expanded their research on information availability not captured by accounting and fundamental factors. Reason for the enlargement of factors have been that accounting and fundamental factors could not fully explain the decline of the beta over time. The study found out that any type of news on a company increases the information availability regarding the company, reduces the uncertainty about the company for investors and hence reduces the beta of the company (Ball and Kothari, 1991). For young companies, the information availability is often very low and thus, there is a high estimation risk for the beta. When the company becomes older, more information will be available and the estimation risk decreases and subsequently, the beta declines over time. As a result, Chincarini, Kim and Moneta (2017) implied for cost of capital user that the beta should be adjusted downward over time.

One important point in the beta discussion is the distinction between an unlevered and levered beta. The theory applied so far assumes that the unlevered beta will decrease over time. However, in the calculation of the required return on equity, the leveraged beta is used which adds the capital structure component to the unlevered beta. Consequently, the capital structure also influences Tesla’s beta. In an earlier section of this study, the future development of Tesla's capital structure was discussed and based on various theories, it was concluded that Tesla will have a much larger debt ratio in the future. Due to the higher debt ratio in companies’ value, the equity is subject to a higher risk, which is represented in the form of beta. This increases the levered beta of Tesla. By approximating the unlevered beta of Tesla to the unlevered beta of competitors, which is supported by the increasing information about Tesla, a decreasing unlevered beta is shown. The change in the capital structure is accompanied by an opposite development of the levered beta since Tesla will probably be financed by a higher debt ratio in the future. It needs to be shown which of the two developments will have a greater impact on the beta. It is difficult to predict and depends on how quickly both the capital structure and the unlevered beta of Tesla will change.

6.3.3.3. Return on Debt

In general, the model as presented by Petersen et al. (2017) is a good way to include the required return on debt in the WACC formula. However, the same problem arises as it occurs in the required return on equity. Petersen et al. (2017) assume that the risk of the company remains the same over time and thus, the required return on debt capital also remains the same over time. The risk-free interest rate usually accounts for only a very small part of the required return on debt. The credit spread therefore plays a more important role. It is made up of the company's probability of default and the loss given default as this determines the company's risk. Especially for young and high-growth companies like Tesla, which do not have a steady cash flow yet, this risk is higher than for established mature companies. The overall risk can be defined here by the business risk and the financial risk. Over time, Tesla's business risk is most likely to decrease, as Tesla is expected to evolve from a rather high-growth company to a mature company, which is associated with a decreasing business risk. As described in the previous section on the capital structure, Tesla is currently mainly financed by equity, so the financial risk of the lenders is quite low. If Tesla changes its capital structure, as assumed in the study, a much larger portion of Tesla is financed by debt and hence the financial risk will increase. However, it can be assumed that the decreasing business risk will have a greater impact than those of increasing financial risk, so that the return on debt required by Tesla will decrease over time. Thus, instead of assuming a static required rate of return, the analyst should take into account that the business and financial risk can change and subsequently the required rate on debt can change as well (Damodaran, 2018).

The discount factor within the framework of the DCF model consists of the capital structure, the required return on equity and the required return on debt. The analysis showed that Tesla's capital structure is likely converging to that of its competitors and that there is probably a significantly higher proportion of debt in the future. The return in equity, which is influenced by the risk of the company as well as the capital structure, also changes. Due to the potentially decreasing business risk of Tesla, the unlevered beta decreases, but since the share of debt at Tesla probably increases at the same time, there are effects that potentially offset each other. Furthermore, a prediction of the required return on debt is problematic. The expected decreasing business risk and the expected increasing financial risk of Tesla are contrary effects influencing the required return on debt. However, if one compares Tesla's required return with that of other companies that are already paying negative interest on their receipts, it can be assumed that Tesla's required return on debt will probably also decrease over time.

6.3.3.4. Taxes

The determination of the tax rate has fewer problems than the factors within the DCF model. The tax rate is set by the state and by law. Thus, large adjustments regarding company-specific factors are less important. Only the distribution of profits in different countries of the world with different tax rates has a high impact on the marginal tax rate. Since Tesla has not made any profits in recent years and therefore did not have to pay taxes, the marginal tax rate is missing. However, since Tesla is aiming at similar markets as the established car manufacturers, they serve as a very good indicator for the calculation of the marginal tax rate in the DCF model.

Summary

In summary, it can be concluded that the variables in the discount factor of Tesla will probably change significantly in the next few years and subsequently, the discount factor changes as well. As proposed in the previous part of this study, these changes should be included in the DCF model. This can be done within the proposed three-stage valuation model including a longer forecast period for Tesla. In the three-stage model the changes in the capital structure, the required rates of return as well as the tax rate over time can be better integrated into the DCF model. The approach of Petersen et al. (2017) without a change in the capital structure and subsequently in the discount factor is not a realistic one. All these variable factors should be considered by the analyst and, if possible, adjust them with realistic assumptions in the valuation of a company to perform a more accurate valuation.

6.4. Characteristics Beyond the DCF Model

In the following section factors that are impacting the DCF valuation but cannot be incorporated directly into the model are discussed. They are beyond the DCF model since they are not related to one specific variable inside the model. In doing so, three factors which are of particular relevance for Tesla's valuation are considered. These are the valuation bias, the black swan and the charismatic leader.

6.4.1. Valuation Bias

Trough external influence people are often influenced in their thinking and decision-making process. These problems are also transferable to the valuation process. Here, analysts are often biased by the external environment and cannot make an objective decision. This problem does not find attention in the standard literature. However, this is generally a problem that one should be aware of in every valuation. The fact that analysts are often biased can easily lead to an under- or overvaluation of the intrinsic enterprise value, depending on the direction of the bias (Gokhale, Tremblay and Tremblay, 2015).

Damodaran (2020) states that almost no valuation is ever started from scratch. Often the valuation is influenced by prejudices and previous views. The consequences are that the more you know about a company and its management, the more likely it is that you are biased. Damodaran (2020) describes various sources of biases. First of all, the power of the subconscious making people vulnerable to herd behaviour. Valuations of intrinsic value follow the market value of the company like an inner magnet. If the valuation of a company on the market is too high due to irrational behaviour, as it was the case during the dotcom bubble, analysts usually adjust their valuations accordingly. Thus, their own valuation is strongly influenced by the market value. Secondly, the suggestive power by which an analyst is influenced by the valuation that other analysts consider justified for the company. Analysts exchange opinions within each other and read different analyst reports and are therefore highly influenced by them. If the analyst considers the other people as informed or smarter, this phenomenon will become even stronger. Thirdly, the power of money, which also influences analysts who have an economic stake in the company, for example with a long or short position. All the above-mentioned problems are certainly applicable to any company in the world, whether start-ups, high-growth companies or mature companies and thus also for Tesla.

Tesla undergoes a massive media attention, that is always driven by hot discussions. This can be confirmed by a Google search, where Tesla comes up with 342 million results, as McDonalds only comes up with 182 million entries. An article from The Verge of 2018 describes the different opinions regarding Tesla as a "group of people who just all scream at each other constantly, the Tesla bulls and the Tesla bears. This picture is also reflected in all kind of topics. For instance, during the release of the new Cyber Truck different opinions clashed. While some people call the truck weird, others like the trucks look (Dow, 2019). There is a lot of information on every topic, which is very often accompanied by an opinion. As Damodaran (n.d.) has already described, any prior knowledge about a company leads to a bias. Since this flood of information often moves very strongly in a positive or negative direction, it can be assumed that the analyst is influenced positively or negatively. People are usually not able to clearly differentiate between information and opinions. Therefore, it is difficult to only take the objective information into account. There are certainly reports about mature companies, but not in such a media overload and such an emotional reporting. Thus, it can be assumed that the bias at Tesla is higher and occurs more often than at mature companies. (Gokhale, Tremblay and Tremblay 2015; Damodaran, 2020).

6.4.2. Charismatic Leader

Over the last decade, some of the most valuable companies have a common phenomenon. The companies themselves and their products are strongly linked to the founder of the companies. Famous examples of this phenomenon are Apple with Steve Jobs, Facebook with Mark Zuckerberg, Amazon with Jeff Bezos and Tesla with Elon Musk. The companies are almost inseparably linked to their founders. Further characteristics are that all of the companies are pioneers in their business area and a myth around these companies is often created. Hereby, the original creator or founder often plays a key role in this myth. The influence of the creators is like an outer shell around the brand identity (König, 2017).

Steve Jobs, Mark Zuckerberg, Jeff Bezos and Elon Musk all share a common attribute that is called innovate capital (Dyer, Furr and Lefrandt, 2019). They are not only able to generate world-changing ideas, they are also able to acquire the capital resources to implement these ideas. Especially, the second attribute is the most distinguished characteristic to other founders. This also applies to Elon Musk. He was able to acquire the necessary funding to turn his visions into reality. This can be confirmed by his prove of record with successful funding for SpaceX, PayPal or Tesla. Furthermore, Musk has already shown with PayPal that he can combine his vision and the necessary funding to develop a company that is profitable and generates returns for shareholders. It should be emphasized that he often puts his visions above monetary success, which is not always in the interest of his shareholders.

Thus, Elon Musk is discussed controversially. Without doubt, he is one of the most charismatic and innovative leaders of this time, who helped to change the automotive industry from the ground up (Dyer, Furr and Lefrandt, 2020). Some people see Elon Musk as a hero and some people see him as a villain (Lopatto, 2018). Lopatto (2018) even emphasizes that everyone is right in their own way, because they only have to put the emphasis on the facts that reinforce their own narrative.

These points above show Musk's high influence on Tesla and subsequently, on the value of the company. The fact that Elon Musk has already successfully founded companies and is able to put his visions into practice has a positive influence on the valuation. Nevertheless, such visionaries always represent a risk for the company as well. This is also the case with Tesla and Elon Musk. Nobody knows what happens if Elon Musk leaves the company and devotes himself to other projects. It is questionable if there is a successor who pursues Elon Musk's visions further or develops new visions with the same enthusiasm as Elon Musk. That Tesla's market value is also significantly influenced by Elon Musk's private behaviour was shown by the case when he smoked a joint with the reporter in a podcast. It is difficult to say whether this behaviour has also changed the intrinsic value of the company and if, how the behaviour should be incorporated into the DCF model (Salinas, 2020)

6.4.3. Black Swan

In the financial literature a term for highly improbable events was established in the last years named Black Swan. According to Taleb (2008), the author who popularised this term, "a Black swan is a highly improbable event [...]". The Black Swan phenomena is described by three characteristics. First, the event is unpredictable meaning that the possibility that the event might happen is not taken into consideration as it is often behind the human imagination. Second, the event has a massive impact on the economy or the society. This massive influence can be either positive or negative. Lastly the event seems much more predictable after it occurred and less uncertain than it was (Taleb, 2008). In the following different Black Swan events are described and the influence on the DCF model is analysed.

Great wars and terrorist attacks are often Black Swans. Both the First as well as the Second World Wars were Black Swans, because in the decades before them, war in Europe was considered a thing of the past. The attack on Pearl Harbour was also completely unexpected and unprecedented. The attack on the Twin Towers on 11 September 2001 was unexpected, unprecedented and had far-reaching consequences for the world. But now that an attack of this magnitude has taken place, most terrorist attacks are no longer Black Swans. The Fukushima nuclear disaster was also a Black Swan, as the nuclear facility was designed to withstand storms and waves far greater than ever before. The introduction of PCs, internet and mobile phones was unexpected and changed the world forever. Although computers have been around for a long time, the fact that they could become so powerful and have such far-reaching effects was never really predicted. When it comes to markets and economies, the global financial crisis in 2007 is the most common example of a Black Swan event. Although there were some predictions about the event, few expected it to have an impact on markets and the global economy. The original crisis may have occurred in the United States, but it has damaged economies around the entire world (Taleb, 2008; Bowman, 2019)

Through the Black Swan phenomenon two questions arise for the valuation of the company. These are whether a Black Swan can be included in the valuation of a company and if it is possible, how it should be included into the valuation. Petersen et al. (2017) are not acknowledging this phenomenon in their valuation. Instead they are stating that "Historic has a tendency to repeat itself" (Petersen et al. 2017, p. 268). They are of the opinion that a valuation can largely be based on the past, as the past has a high probability of repetition. But Black Swans are events that are having major impact on the whole economy which are not derivable from the past as they are unforeseeable.

Black Swans can have both positive and negative effects on the economy. Positive Black Swans, such as the invention of the internet or smartphones, are innovations that have led to an increase in the world's overall productivity. A large part of the economic impact of positive Black Swans are already included within the DCF, as a general assumption of continuous economic growth. However, the acknowledgment of Black Swans that have a negative impact on the economy are not included in the DCF model. The well-known Black Swans that impacted the world economy negatively in the last decades have been the Oil Crisis in 1979, Black Monday in 1987, the Dotcom Bubble in 2000, the Financial crisis in 2007 and the current Corona crisis in 2020 (Babus, Carletti and Allen, 2009). Each of these Black Swans had its own unique cause, but all of them led to an economic downturn. The important point is not which reason led to that downturn, more important is the triggered result. The above examples indicate that in the recent years every seventh to thirteenth years a Black Swan led to an economic crisis. Based on these observations, it is not possible to maintain the DCF model's basic assumption of steady economic growth. Even if the Black Swans are not foreseeable, every Black Swan had a negative impact on the economy. Thus, the DCF should be adjusted either during the forecast period or the terminal value, depending of the duration of the forecast period, for economic crises. A possible idea to solve the problem of bankruptcy risk is to include this risk into the valuation. For example, Damodaran (2020) uses a risk of bankruptcy in his Tesla valuation from January 2020. In order to integrate the downside risk of negative black swans, which are generally not included in a valuation model, it is advisable to proceed in a similar way as Damodaran (2020) does it in its valuation models regarding Tesla. In doing so, he includes a 10% probability in his valuation model that Tesla's business model will not work as predicted in his forecast and will therefore receive a significantly lower valuation than in the predicted case. The same could be done for the black swan and thus integrate a downside risk into the valuation.

7. Conclusion

The aim of this research project was to analyse the applicability of the standard DCF model in the valuation of high-growth companies, to identify potential weaknesses and to further improve the model for a more accurate valuation. The research question emerged due to the real-life observation that company valuation is not as easy and straightforward as it is claimed by Petersen et al. (2017) in their financial analysis book.

First and foremost, this study has revealed that predicting future developments is especially difficult for young and high-growth companies. The strategic value driver analysis has demonstrated that Tesla is operating in an uncertain market environment with many different macro-economic governmental regulations regarding autonomous driving or competition from hydrogen as another potential drive systems. In addition, Tesla has several products in the pipeline like the Tesla Semi or the ride-hailing app where besides the question if and when the products will be on the market, the question is if the products will be successful. The strategic analysis conducted with the PESTLE analysis, Porter's five forces analysis and the adapted value chain analysis are not entirely capable to incorporate these uncertainties as the three tools presume a rather stable and unchanging environment instead of a turbulent one. Nevertheless, it is important to try to create an as accurate as possible reflection of the future. Even though the tools have several drawbacks, the three tools are still able to depict a best possible picture of the macroenvironment, the industry and the company. To achieve a more accurate picture of the reality, the tools need to be adapted to the changing environment to mitigate the above-mentioned problems. Especially, the interrelationships and interdependencies between and within the analysis tools have to be considered to mitigate their weaknesses. In addition, it is important to rethink the traditional industries classification as Tesla can be classed as a tech or a car company and subsequently has competitors from different industries. As an example, it is reasonable to think about Tesla in terms of mobility instead of only automotive. This enables a better benchmarks identification for Porter's five-force analysis and for the adapted value chain analysis. Hence, it is despite the aforementioned weaknesses possible to identify a main part of strategic value drivers.

According to Petersen et al. (2017), the preparation of the financial value drivers is based on a combination of the historical financials of the company and on the previously identified strategic value drivers. However, especially in the case of high-growth companies, past financials drivers often fluctuate strongly, and a clear trend is not observable. This could also be identified at Tesla where sales growth has fluctuated between 15% and 83% in recent years. As the past financial cannot be used for Tesla as a solid for the preparation of proforma statements, the identified play an even more important role for high-growth companies. The fundamental problem of the transformation process of strategic value drivers is that qualitative statements must be converted into quantitative figures. Petersen et al. (2017) do not offer a solid solution regarding the transformation process. A possible solution to deal with this problem is to extend the valuation model with the Monte Carlo Simulation. Thereby the strategic value drivers do not have to be transformed into single fixed values. Rather it is possible to represent each financial value driver with a distribution function. Thus, the possible wide range of scenarios for Tesla's financial value drivers can be included. The Monte Carlo Simulation can then be used to combine the various input variables in countless simulations and thus, achieve a potentially better outcome than it would be the case while using single figures for the financial value drivers.

In the technical aspects of the standard DCF model time, terminal value and discount factor should be considered. The analysis illustrated that it is important to take the company specific characteristics as well as the changing business environment into account. For the length of the forecast period, a significantly higher variability is necessary to ensure that the current and future strategic value drivers of Tesla are incorporated. High-growth companies like Tesla do not achieve a steady growth within four or five years. Scientific studies and papers prove that Tesla will have an advantage over its competitors for many years to come.

A three-day model can be used to avoid having to make a pro forma statement for every year in which Tesla has not yet achieved steady growth in line with the overall growth of the economy. This allows an explicit forecast in the form of a pro forma statement to be made for each year individually over a period of 10 years. Furthermore, a second stage is built in, in which Tesla has a growth rate that is higher than that of the overall economy, but the growth rate is already constant. This means that no individual pro forma statements have to be created for these years. Finally, there is a step in the form of the terminal value. Thus, this should be integrated into a three-stage model in order to obtain a much longer forecast horizon and still not have to forecast the pro forma statements for the next 20 years.

Furthermore, the general assumption of the infinite life of companies should be questioned. Studies have proven that the life cycle of companies has decreased significantly compared to many decades ago when the DCF model was developed. Structural changes such as mergers and acquisitions and the bankruptcy of companies mean that it is no longer appropriate to determine only a terminal value based on a growth model. Rather, it makes sense to conduct a scenario analysis and thus cover the possible scenarios in the form of mergers and acquisitions, liquidation and the going concern of the company that the company should face. In the context of the discount factor the company life cycle plays a relevant role. The classification of the company in the company life cycle has an influence on the capital structure, the returned return on equity and the required return on debt. Young and high-growth companies like Tesla have a high business risk and therefore usually only take a low financial risk in the form of a high debt ratio. Thus, high-growth companies are mostly equity financed. Regarding the required return on equity and the required return on debt, the development from a high-growth company to a mature company is contradictory. However, if the capital structure changes and the debt ratio rises, the returned return on equity and the returned return on debt increase. It is difficult to predict which of these two trends is stronger and must be determined on a case basis for Tesla.

“You cannot value this with a DCF model, can you?” is a recurring question the “Dean of Valuation” Aswath Damodaran (2018) is questioned about an uncommon or unusual scenario from analysts, students and investors. His answer is always: “Of course, you can”. This is also revealed in this study that also high-growth companies like Tesla which are operating in a dynamic and changing environment can be valued with the DCF model. However, this study proves that the standard DCF model is too static to incorporate companies’ unique characteristics. More or less the standard DCF model tries to value different companies with almost the same model. However, as especially high-growth companies like Tesla are unique the model must be modified for each company individually. The full range of flexibility offered by the DCF method should be used to include company-specific factors and thus enable a more detailed valuation.

8. Further Research

The last chapter is dedicated to reflecting on the academic significance of this study and provide suggestions on how future studies can confirm and further develop the DCF valuation. This study demonstrated the applicability of the standard DCF model to value Tesla and identified possible adjustments and improvements that should be made to incorporate the dynamic economic environment and the characteristics of a high-growth company like Tesla. Instead of providing statistical evidence regarding the valuation model, this study aimed to identify problems within each stage of the standard DCF model and to offer potential solutions to solve these problems. Within the framework of this study, three areas are recognized in which further research should be undertaken to confirm the work of this study and to further improve the DCF model.

Firstly, even if many findings are probably transferable to other companies, in order to generalise and support the findings presented in this study, it is necessary to examine the same aspects in other high-growth companies. In this way, a better breakdown into structural problems of the standard DCF model and company-specific factors can be made. For example, many of the contextual details discussed in this study that may have influenced the results relate specifically to Tesla and its market environment. It is therefore useful to conduct the analysis with other companies.

Secondly, to review the suggested improvements in this study, the suggested improvements should be applied in a real valuation. This could be done by using data to check whether the modified model have a higher accuracy in valuing companies than the standard DCF model. It is problematic to test the models based on past data, since the quality of a valuation model is largely measured by how it deals with uncertainty. This is particularly difficult in predicting the strategic value drivers. Since it is already known how Tesla has developed in recent years, it is no longer possible to "predict" this development without prejudice. Rather, it would make more sense to conduct a longitudinal study and test both models for a longer period in the future. At the same time, with the help of the sensitivity analysis, it can be identified to what extent the parts of the adjusted valuation model impact the company valuation. Since some of the adjustments require considerable additional work compared to the standard model, it is possible to see for which factors this adjustment is appropriate as it impacts the value significantly.

Lastly, as already described in the analysis, the forecasting process has the greatest impact on the value of the company. But especially in company valuation, almost all variables are still based on assumptions and subsequently on the personal expertise of the analyst. This is often leading to imprecise and biased forecasts as this study has demonstrated. A study from Hutton, Lee and Shu (2010) has proven that even management earnings forecasts about their company are only in 50% better than analysts' forecasts, even though one can argue that that management has an information advantage over analysts and thus should give more accurate earnings forecasts. This underlines once again the difficulty of earnings forecasts. The proposed Monte Carlo Simulation in this study as a solution cannot completely eliminate these problems either, as also in the Monte Carlo Simulation decisive input variables must be estimated by the analyst.

Thus, to further increase the forecast accuracy Big Data and Artificial Intelligence should be integrated into the valuation process in order that the forecast process is less dependent on the analyst's assumptions. Currently, there is relatively little research about Big Data and Artificial Intelligence in combination with company valuation especially in the DCF model. In other finance areas like Asset Allocation, Big Data and Artificial Intelligence are already used successfully. For instance, as one of the most famous examples BlackRock uses its data analyst tool Aladdin (Betz, 2016; McAfee and Brynjolfsson). A similar modified system could be used to forecast especially the strategic value driver to achieve higher forecast accuracy which ultimately leads to a more precise valuation. Thus, as there are not many research projects in this area, more research should be done within the field of the use of Artificial Intelligence and Big Data in valuation.

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10. Appendix

A.1 Tesla - Income Statement

Annual Income Statement

	12/31/2019 USD	12/31/2018 USD	12/31/2017 USD restated	12/31/2016 USD	12/31/2015 USD
Income Statement					
Net Sales or Revenues	24,578.0	21,461.3	11,758.8	7,000.1	4,046.0
Operating Expenses - Total	24,498.0	21,714.1	13,390.8	7,667.5	4,762.7
Cost of Goods Sold	18,402.0	15,518.2	7,900.3	4,453.8	2,699.9
Selling, General & Admin Expenses	3,989.0	4,294.9	3,854.6	2,266.6	1,640.1
Depreciation, Depletion & Amortization	2,107.0	1,901.1	1,636.0	947.1	422.6
Depreciation	-	-	-	-	278.7
Amortization of Intangibles	-	-	-	-	143.9
Amortization of Deferred Charges	-	-	-	-	-
Other Operating Expenses	0.0	0.0	0.0	0.0	0.0
Operating Income	80.0	(252.8)	(1,632.1)	(667.3)	(716.6)
Extraordinary Credit - Pretax	0.0	0.0	0.0	0.0	0.0
Extraordinary Charge - Pretax	196.0	135.2	0.0	0.0	0.0
Non-Operating Interest Income	44.0	24.5	19.7	8.5	1.5
Interest Expense On Debt	716.0	718.0	596.2	245.5	160.4
Pretax Equity In Earnings	0.0	0.0	0.0	0.0	0.0
Reserves- Increase(Decrease)	-	-	-	-	-
Other Income/Expense - Net	92.0	21.9	(125.4)	111.3	(41.7)
Interest Capitalized	31.0	54.9	124.9	46.7	41.5
Pretax Income	(665.0)	(1,004.7)	(2,209.0)	(746.3)	(875.6)
Income Taxes	110.0	57.8	(691.1)	26.7	13.0
Current Domestic Income Tax	5.0	1.9	(730.2)	0.6	0.5
Current Foreign Income Tax	86.0	23.6	42.7	54.0	10.3
Deferred Domestic Income Tax	(4.0)	0.0	0.0	0.0	0.0
Deferred Foreign Income Tax	23.0	32.3	(3.6)	(27.8)	2.2
Income Tax Credits	-	-	-	-	-
Minority Interest	87.0	(86.5)	(279.2)	(98.1)	0.0
Equity In Earnings	0.0	0.0	0.0	0.0	0.0
After Tax Other Income/Expense	0.0	0.0	0.0	0.0	0.0
Discontinued Operations	0.0	0.0	0.0	0.0	0.0
Net Income Before Extra Items/Preferred Div	(862.0)	(976.1)	(1,238.8)	(674.9)	(888.7)
Extr Items & Gain(Loss) Sale of Assets	0.0	0.0	(722.6)	0.0	0.0
Net Income Before Preferred Dividends	(862.0)	(976.1)	(1,961.4)	(674.9)	(888.7)
Preferred Dividend Require	0.0	0.0	0.0	0.0	0.0
Net Income to Common Shareholders	**(862.0)**	**(976.1)**	**(1,238.8)**	**(674.9)**	**(888.7)**
EPS Incl Extraordinary Items	(1.0)	(1.1)	(2.4)	(0.9)	(1.4)
EPS - Continuing Operations	(1.0)	(1.1)	(1.5)	(0.9)	(1.4)
Dividend Per Share	0.0	0.0	0.0	0.0	0.0
Common Shares Used to Calc Diluted EPS	885,000,000.0	852,625,000.0	828,790,000.0	721,060,000.0	641,010,000.0

All figures in millions of Euro.

Source: ThomsonOne, 2020

A.2 Tesla – Balance Sheet

Annual Balance Sheet	12/31/2019 USD	12/31/2018 USD	12/31/2017 USD restated	12/31/2016 USD	12/31/2015 USD
Assets					
Cash & ST Investments	6,514.0	3,878.2	3,523.2	3,498.7	1,219.5
Cash	6,514.0	3,878.2	3,523.2	3,498.7	1,219.5
Short Term Investments	-	-	-	-	-
Receivables (Net)	1,324.0	949.0	515.4	499.1	169.0
Inventories - Total	3,552.0	3,113.4	2,263.5	2,067.5	1,277.8
Raw Materials	1,428.0	931.8	821.4	680.3	528.9
Work In Process	362.0	297.0	243.2	233.7	163.8
Finished Goods	1,356.0	1,581.8	1,013.9	1,016.7	476.5
Progress Payments & Other	406.0	302.9	185.1	136.6	108.6
Prepaid Expenses	-	-	-	-	-
Other Current Assets	713.0	365.7	268.4	194.5	125.2
Current Assets - Total	**12,103.0**	**8,306.3**	**6,570.5**	**6,259.8**	**2,791.6**
Long Term Receivables	393.0	421.5	456.7	506.3	0.0
Investment In Unconsolidated Subsidiaries	0.0	0.0	0.0	0.0	0.0
Other Investments	269.0	398.2	441.7	268.2	31.5
Property Plant & Equipment - Net	20,199.0	19,691.2	20,491.6	15,036.9	5,194.7
Property Plant & Equipment - Gross	25,062.0	23,343.4	22,215.4	16,034.4	5,765.9
Land	-	-	-	-	60.2
Buildings	3,024.0	4,047.0	2,517.2	1,079.5	461.3
Construction Work In Progress	764.0	807.3	-	2,147.3	693.2
Machinery & Equipment	8,660.0	7,726.5	5,507.7	2,949.2	2,245.8
Rental/Lease Property	2,853.0	2,547.4	4,116.6	3,134.1	1,791.4
Transportation Equipment	-	-	-	-	-
PP&E - Other	(1,429.0)	(1,738.1)	789.8	528.8	338.4
PP&E Under Capitalized Leases	6,861.0	6,766.9	6,347.5	5,919.9	-
(Less) Accumulated Depreciation	4,863.0	3,652.2	1,723.8	997.5	571.1
Accum Depr-Land	-	-	-	-	-
Accum Depr-Buildings	-	-	-	-	-
Accum Depr-Machinery & Equip.	-	-	-	-	-
Accum Depr-Rental/Lease Property	406.0	457.6	-	-	-
Accum Depr-Transport Equip.	-	-	-	-	-
Accum Depr-PP&E Other	3,734.0	2,699.1	-	-	-
Accum Depr-PP&E Under Cap Leases	723.0	495.5	-	-	-
Other Assets	1,345.0	922.3	694.9	592.9	74.6
Deferred Charges	0.0	0.0	0.0	0.0	0.0
Tangible Other Assets	808.0	571.7	273.1	216.8	74.6
Intangible Other Assets	537.0	350.7	421.7	376.1	0.0
Total Assets	**34,309.0**	**29,739.6**	**28,655.4**	**22,664.1**	**8,092.5**
Liabilities					
Accounts Payable	3,771.0	3,404.5	2,390.3	1,860.3	916.1
ST Debt & Current Portion of LT Debt	1,785.0	2,567.7	896.5	1,150.1	633.2
Accrued Payroll	466.0	448.8	378.3	218.8	86.9
Income Taxes Payable	611.0	348.7	185.8	152.9	101.2
Dividends Payable	-	-	-	-	-
Other Current Liabilities	4,034.0	3,222.5	3,823.8	2,444.8	1,078.9
Current Liabilities - Total	**10,667.0**	**9,992.1**	**7,674.7**	**5,827.0**	**2,816.3**
Long Term Debt	11,634.0	9,403.7	9,418.4	5,978.3	2,082.4
LT Debt Excl Capital Leases	10,402.0	8,410.5	8,829.1	5,978.3	2,082.4
Non-Convertible Debt	10,402.0	8,410.5	8,826.5	5,959.2	2,040.4
Convertible Debt	0.0	0.0	2.6	19.1	42.0
Capitalized Lease Obligations	1,232.0	993.2	589.3	-	-
Provision for Risks & Charges	-	-	-	-	-
Deferred Income	1,207.0	990.9	1,177.8	851.8	446.1
Deferred Taxes	-	-	-	-	-
Deferred Taxes - Credit	-	-	-	-	-
Deferred Taxes - Debit	-	-	-	-	-
Deferred Tax Liability In Untaxed Reserves	-	-	-	-	-
Other Liabilities	2,691.0	3,039.3	4,752.2	4,101.9	1,658.7
Total Liabilities	**26,199.0**	**23,426.0**	**23,023.1**	**16,759.0**	**7,003.5**
Shareholders' Equity					
Non-Equity Reserves	0.0	0.0	0.0	0.0	0.0
Minority Interest	1,492.0	1,390.4	1,395.1	1,152.2	0.0
Preferred Stock	0.0	0.0	0.0	0.0	0.0
Preferred Stock - Non Redeemable	0.0	0.0	0.0	0.0	0.0
Preferred Stock - Redeemable	0.0	0.0	0.0	0.0	0.0
Common Equity	6,618.0	4,923.2	4,237.2	4,752.9	1,088.9
Common Stock	0.2	0.2	0.2	0.2	0.1
Capital Surplus	12,736.8	10,249.1	9,178.0	7,773.7	3,414.7
Revaluation Reserves	0.0	0.0	0.0	0.0	0.0
Other Appropriated Reserves	(36.0)	(8.2)	33.3	(23.7)	(3.6)
Unappropriated (Free) Reserves	-	-	-	-	-
Retained Earnings	(6,083.0)	(5,317.8)	(4,974.3)	(2,997.2)	(2,322.3)
Equity In Untaxed Reserves	-	-	-	-	-
ESOP Guarantees	0.0	0.0	0.0	0.0	0.0
Unrealized Foreign Exchange Gain(Loss)	0.0	0.0	0.0	0.0	0.0
Unrealized Gain(Loss) on Marketable Securities	0.0	0.0	0.0	0.0	0.0
(Less) Treasury Stock	0.0	0.0	0.0	0.0	0.0
Total Shareholders Equity	**6,618.0**	**4,923.2**	**4,237.2**	**4,752.9**	**1,088.9**
Total Liabilities & Shareholders Equity	**34,309.0**	**29,739.6**	**28,655.4**	**22,664.1**	**8,092.5**
Common Shares Outstanding	905.0	863.0	844.0	807.8	657.1

Source: ThomsonOne, 2020

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A.3 Tesla - Cash flow Statement

Annual Cash Flow Statement	12/31/2019 USD	12/31/2018 USD	12/31/2017 USD restated	12/31/2016 USD	12/31/2015 USD
Operations					
Net Income / Starting Line	(775.0)	(1,062.6)	-	(773.0)	(888.7)
Depreciation, Depletion & Amortization	2,154.0	1,901.1	1,636.0	947.1	422.6
Depreciation & Depletion	2,154.0	1,901.1	-	947.1	278.7
Amortization of Intangible Assets	-	-	-	-	143.9
Deferred Income Taxes & Investment Tax Credit	-	-	-	-	-
Deferred Income Taxes	-	-	-	-	-
Investment Tax Credits	-	-	-	-	-
Other Cash Flow	1,375.0	1,201.4	1,040.5	396.0	434.9
Funds From Operations	2,754.0	2,039.9	435.9	570.0	(31.2)
Extraordinary Items	0.0	0.0	-	0.0	0.0
Funds From/For Other Operating Activities	(349.0)	58.0	(496.6)	(693.9)	(493.3)
Dec(Inc) In Receivables	(367.0)	(496.7)	(24.6)	(213.1)	46.3
Dec(Inc) In Inventories	(429.0)	(1,023.3)	(178.9)	(2,465.7)	(1,573.9)
Inc(Dec) In Accounts Payable	682.0	1,722.9	388.2	750.6	263.3
Inc(Dec) In Income Taxes Payable	-	-	-	-	-
Inc(Dec) In Other Accruals	-	-	-	-	-
Dec(Inc) In Other Assets/Liabilities	(235.0)	(144.9)	(681.3)	1,234.3	771.0
Net Cash Flow - Operating Activities	**2,405.0**	**2,097.8**	**(60.7)**	**(123.8)**	**(524.5)**
Investing					
Capital Expenditures (Addition to Fixed Assets)	(1,432.0)	(2,319.5)	(4,081.4)	(1,440.5)	(1,634.9)
Additions To Other Assets	(5.0)	-	-	-	0.0
Net Assets From Acquisitions	(45.0)	(17.9)	(114.5)	213.5	(12.3)
Increase In Investments	0.0	0.0	0.0	0.0	0.0
Decrease In Investments	0.0	0.0	0.0	16.7	0.0
Disposal of Fixed Assets	-	-	-	-	-
Other Use/(Source) - Investing	(46.0)	0.0	223.1	206.1	26.4
Other Uses - Investing	0.0	0.0	(223.1)	(206.1)	(26.4)
Other Sources - Investing	46.0	0.0	0.0	0.0	0.0
Net Cash Flow - Investing	**(1,436.0)**	**(2,337.4)**	**(4,419.0)**	**(1,416.4)**	**(1,673.6)**
Financing					
Net Proceeds From Sale/Issue of Com & Pref	1,285.0	295.7	712.2	1,865.6	856.6
Proceeds From Stock Options	437.0	295.7	312.0	163.8	106.6
Other Proceeds From Sale/Issuance of Stock	848.0	0.0	400.2	1,701.7	750.0
Com/Pfd Purchased	0.0	(0.0)	(230.4)	0.0	0.0
Long Term Borrowings	10,669.0	6,176.2	7,649.4	3,622.7	887.7
Reduction In Long Term Debt	(9,871.0)	(6,087.0)	(4,263.8)	(1,904.5)	(203.8)
Inc(Dec) In Short Term Borrowings	-	-	-	-	-
Cash Dividends Paid - Total	0.0	0.0	0.0	0.0	0.0
Common Dividends (Cash)	0.0	0.0	0.0	0.0	0.0
Preferred Dividends (Cash)	0.0	0.0	0.0	0.0	0.0
Other Source (Use) - Financing	(554.0)	188.9	547.5	160.2	(17.0)
Other Sources - Financing	279.0	437.1	1,076.9	201.5	0.0
Other Uses - Financing	(833.0)	(248.2)	(529.4)	(41.3)	(17.0)
Net Cash Flow - Financing	**1,529.0**	**573.8**	**4,414.9**	**3,744.0**	**1,523.5**
Effect of Exchange Rate On Cash	8.0	(22.7)	39.5	(7.4)	(34.3)
Inc(Dec) In Cash & Short Term Investments	**2,506.0**	**311.4**	**(25.3)**	**2,196.3**	**(708.8)**

All figures in millions of Euro.

Source: ThomsonOne, 2020

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A.4 Tesla – Financial Ratios

Annual Key Financial Items	12/31/2019 USD	12/31/2018 USD	12/31/2017 USD restated	12/31/2016 USD	12/31/2015 USD
Income Statement Key Items					
Net Sales or Revenues	24,578.0	21,461.3	11,758.8	7,000.1	4,046.0
Growth	14.52%	82.51%	67.98%	73.01%	26.50%
Cost of Goods Sold	18,402.0	15,518.2	7,900.3	4,453.8	2,699.9
% of Sales	74.87%	72.31%	67.19%	63.62%	66.73%
Gross Profit	4,069.0	4,042.0	2,222.5	1,599.3	923.5
Gross Margin	16.56%	18.83%	18.90%	22.85%	22.82%
Selling, General & Admin Expenses	3,989.0	4,294.9	3,854.6	2,266.6	1,640.1
% of Sales	10.77%	13.21%	21.06%	20.46%	22.79%
EBITDA	2,127.0	1,559.4	(101.8)	399.6	(334.2)
EBITDA Margin	8.65%	7.27%	(0.87%)	5.71%	(8.26%)
Operating EBITDA	2,187.0	1,648.2	3.9	279.8	(294.0)
Operating EBITDA Margin	8.90%	7.68%	0.03%	4.00%	(7.27%)
EBIT	20.0	(341.7)	(1,737.8)	(547.5)	(756.8)
EBIT Margin	0.08%	(1.59%)	(14.78%)	(7.82%)	(18.70%)
Operating EBIT	80.0	(252.8)	(1,632.1)	(667.3)	(716.6)
Operating EBIT Margin	0.33%	(1.18%)	(13.88%)	(9.53%)	(17.71%)
Pretax Income	(665.0)	(1,004.7)	(2,209.0)	(746.3)	(875.6)
Pretax Margin	(2.71%)	(4.68%)	(18.79%)	(10.66%)	(21.64%)
Net Income to Common Shareholders	(862.0)	(976.1)	(1,238.8)	(674.9)	(888.7)
Net Margin	(3.51%)	(4.55%)	(16.68%)	(9.64%)	(21.96%)
EPS - Continuing Operations	(1.0)	(1.1)	(1.5)	(0.9)	(1.4)
Growth	(14.92%)	(23.41%)	59.68%	(32.48%)	193.59%
Dividend Per Share	0.0	0.0	0.0	0.0	0.0
Balance Sheet Key Items					
Total Assets	34,309.0	29,739.6	28,655.4	22,664.1	8,092.5
Cash & ST Investments	6,514.0	3,878.2	3,523.2	3,498.7	1,219.5
% of Assets	18.99%	13.04%	12.30%	15.44%	15.07%
Receivables (Net)	1,324.0	949.0	515.4	499.1	169.0
% of Assets	3.86%	3.19%	1.80%	2.20%	2.09%
Inventories - Total	3,552.0	3,113.4	2,263.5	2,067.5	1,277.8
% of Assets	10.35%	10.47%	7.90%	9.12%	15.79%
Current Assets - Total	12,103.0	8,306.3	6,570.5	6,259.8	2,791.6
% of Assets	35.28%	27.93%	22.93%	27.62%	34.50%
Property Plant & Equipment - Net	20,199.0	19,691.2	20,491.6	15,036.9	5,194.7
% of Assets	58.87%	66.21%	71.51%	66.35%	64.19%
Other Assets	1,345.0	922.3	694.9	592.9	74.6
% of Assets	3.92%	3.10%	2.42%	2.62%	0.92%
Accounts Payable	3,771.0	3,404.5	2,390.3	1,860.3	916.1
% of Assets	10.99%	11.45%	8.34%	8.21%	11.32%
ST Debt & Current Portion of LT Debt	1,785.0	2,567.7	896.5	1,150.1	633.2
% of Assets	5.20%	8.63%	3.13%	5.07%	7.82%
Other Current Liabilities	4,034.0	3,222.5	3,823.8	2,444.8	1,078.9
% of Assets	11.76%	10.84%	13.34%	10.79%	13.33%
Current Liabilities - Total	10,667.0	9,992.1	7,674.7	5,827.0	2,816.3
% of Assets	31.09%	33.60%	26.78%	25.71%	34.80%
Long Term Debt	11,634.0	9,403.7	9,418.4	5,978.3	2,082.4
% of Assets	33.91%	31.62%	32.87%	26.38%	25.73%
Other Liabilities	2,691.0	3,039.3	4,752.2	4,101.9	1,658.7
% of Assets	7.84%	10.22%	16.58%	18.10%	20.50%
Total Liabilities	26,199.0	23,426.0	23,023.1	16,759.0	7,003.5
% of Assets	76.36%	78.77%	80.34%	73.95%	86.54%
Total Shareholders Equity	6,618.0	4,923.2	4,237.2	4,752.9	1,088.9
% of Assets	19.29%	16.55%	14.79%	20.97%	13.46%
Total Liabilities & Shareholders Equity	34,309.0	29,739.6	28,655.4	22,664.1	8,092.5
Common Shares Outstanding	905.0	863.0	844.0	807.8	657.1
Cash Flow Statement Key Items					
Net Income / Starting Line	(775.0)	(1,062.6)	-	(773.0)	(888.7)
Depreciation, Depletion & Amortization	2,154.0	1,901.1	-	947.1	422.6
Deferred Income Taxes & Investment Tax Credit	-	-	-	-	-
Funds From Operations	2,754.0	2,039.9	-	570.0	(31.2)
Net Cash Flow - Operating Activities	2,405.0	2,097.8	-	(123.8)	(524.5)
Capital Expenditures (Addition to Fixed Assets)	1,432.0	2,319.5	-	1,440.5	1,634.9
Increase In Investments	0.0	0.0	-	0.0	0.0
Decrease In Investments	0.0	0.0	-	16.7	0.0
Disposal of Fixed Assets	-	-	-	-	-
Net Cash Flow - Investing	1,436.0	2,337.4	-	1,416.4	1,673.6
Net Proceeds From Sale/Issue of Com & Pref	1,285.0	295.7	-	1,865.6	856.6
Com/Pfd Purchased	0.0	0.0	-	0.0	0.0
Long Term Borrowings	10,669.0	6,176.2	-	3,622.7	887.7
Reduction In Long Term Debt	9,871.0	6,087.0	-	1,904.5	203.8
Cash Dividends Paid - Total	0.0	0.0	-	0.0	0.0
Net Cash Flow - Financing	1,529.0	573.8	-	3,744.0	1,523.5
Free Cash Flow Per Share	0.0	(0.0)	(0.0)	(0.0)	(0.0)

All figures in millions of Euro. Growth & ratios are calculated in local currency (U.S. Dollar).

Source: ThomsonOne, 2020

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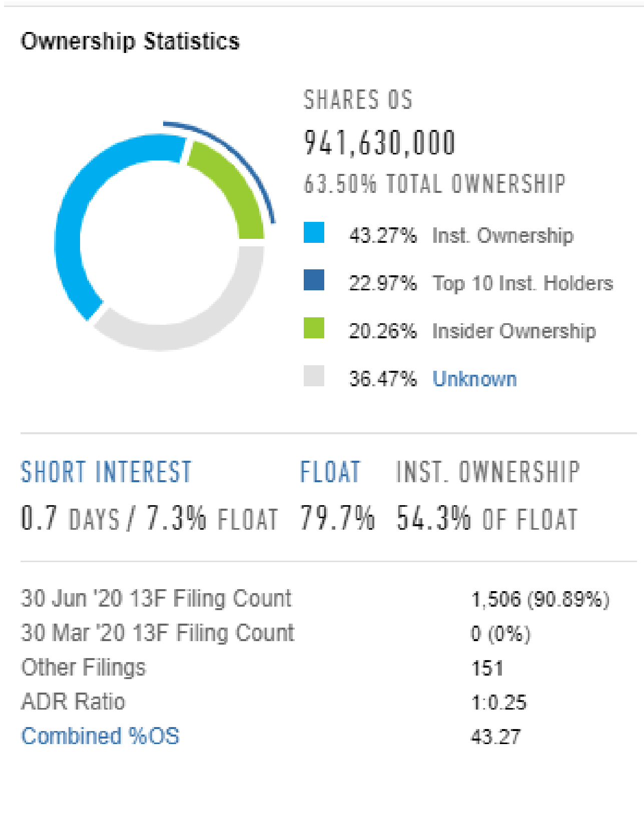
A.5 Tesla – Key financial items

Annual Key Financial Items	12/31/2019 USD	12/31/2018 USD	12/31/2017 USD restated	12/31/2016 USD	12/31/2015 USD
Income Statement Key Items					
Net Sales or Revenues	24,578.0	21,461.3	11,758.8	7,000.1	4,046.0
Growth	14.52%	82.51%	67.98%	73.01%	26.50%
Cost of Goods Sold	18,402.0	15,518.2	7,900.3	4,453.8	2,699.9
% of Sales	74.87%	72.31%	67.19%	63.62%	66.73%
Gross Profit	4,069.0	4,042.0	2,222.5	1,599.3	923.5
Gross Margin	16.56%	18.83%	18.90%	22.85%	22.82%
Selling, General & Admin Expenses	3,989.0	4,294.9	3,854.6	2,266.6	1,640.1
% of Sales	10.77%	13.21%	21.06%	20.46%	22.79%
EBITDA	2,127.0	1,559.4	(101.8)	399.6	(334.2)
EBITDA Margin	8.65%	7.27%	(0.87%)	5.71%	(8.26%)
Operating EBITDA	2,187.0	1,648.2	3.9	279.8	(294.0)
Operating EBITDA Margin	8.90%	7.68%	0.03%	4.00%	(7.27%)
EBIT	20.0	(341.7)	(1,737.8)	(547.5)	(756.8)
EBIT Margin	0.08%	(1.59%)	(14.78%)	(7.82%)	(18.70%)
Operating EBIT	80.0	(252.8)	(1,632.1)	(667.3)	(716.6)
Operating EBIT Margin	0.33%	(1.18%)	(13.88%)	(9.53%)	(17.71%)
Pretax Income	(665.0)	(1,004.7)	(2,209.0)	(746.3)	(875.6)
Pretax Margin	(2.71%)	(4.68%)	(18.79%)	(10.66%)	(21.64%)
Net Income to Common Shareholders	(862.0)	(976.1)	(1,238.8)	(674.9)	(888.7)
Net Margin	(3.51%)	(4.55%)	(16.68%)	(9.64%)	(21.96%)
EPS - Continuing Operations	(1.0)	(1.1)	(1.5)	(0.9)	(1.4)
Growth	(14.92%)	(23.41%)	59.68%	(32.48%)	193.59%
Dividend Per Share	0.0	0.0	0.0	0.0	0.0
Balance Sheet Key Items					
Total Assets	34,309.0	29,739.6	28,655.4	22,664.1	8,092.5
Cash & ST Investments	6,514.0	3,878.2	3,523.2	3,498.7	1,219.5
% of Assets	18.99%	13.04%	12.30%	15.44%	15.07%
Receivables (Net)	1,324.0	949.0	515.4	499.1	169.0
% of Assets	3.86%	3.19%	1.80%	2.20%	2.09%
Inventories - Total	3,552.0	3,113.4	2,263.5	2,067.5	1,277.8
% of Assets	10.35%	10.47%	7.90%	9.12%	15.79%
Current Assets - Total	12,103.0	8,306.3	6,570.5	6,259.8	2,791.6
% of Assets	35.28%	27.93%	22.93%	27.62%	34.50%
Property Plant & Equipment - Net	20,199.0	19,691.2	20,491.6	15,036.9	5,194.7
% of Assets	58.87%	66.21%	71.51%	66.35%	64.19%
Other Assets	1,345.0	922.3	694.9	592.9	74.6
% of Assets	3.92%	3.10%	2.42%	2.62%	0.92%
Accounts Payable	3,771.0	3,404.5	2,390.3	1,860.3	916.1
% of Assets	10.99%	11.45%	8.34%	8.21%	11.32%
ST Debt & Current Portion of LT Debt	1,785.0	2,567.7	896.5	1,150.1	633.2
% of Assets	5.20%	8.63%	3.13%	5.07%	7.82%
Other Current Liabilities	4,034.0	3,222.5	3,823.8	2,444.8	1,078.9
% of Assets	11.76%	10.84%	13.34%	10.79%	13.33%
Current Liabilities - Total	10,667.0	9,992.1	7,674.7	5,827.0	2,816.3
% of Assets	31.09%	33.60%	26.78%	25.71%	34.80%
Long Term Debt	11,634.0	9,403.7	9,418.4	5,978.3	2,082.4
% of Assets	33.91%	31.62%	32.87%	26.38%	25.73%
Other Liabilities	2,691.0	3,039.3	4,752.2	4,101.9	1,658.7
% of Assets	7.84%	10.22%	16.58%	18.10%	20.50%
Total Liabilities	26,199.0	23,426.0	23,023.1	16,759.0	7,003.5
% of Assets	76.36%	78.77%	80.34%	73.95%	86.54%
Total Shareholders Equity	6,618.0	4,923.2	4,237.2	4,752.9	1,088.9
% of Assets	19.29%	16.55%	14.79%	20.97%	13.46%
Total Liabilities & Shareholders Equity	34,309.0	29,739.6	28,655.4	22,664.1	8,092.5
Common Shares Outstanding	905.0	863.0	844.0	807.8	657.1
Cash Flow Statement Key Items					
Net Income / Starting Line	(775.0)	(1,062.6)	-	(773.0)	(888.7)
Depreciation, Depletion & Amortization	2,154.0	1,901.1	-	947.1	422.6
Deferred Income Taxes & Investment Tax Credit	-	-	-	-	-
Funds From Operations	2,754.0	2,039.9	-	570.0	(31.2)
Net Cash Flow - Operating Activities	2,405.0	2,097.8	-	(123.8)	(524.5)
Capital Expenditures (Addition to Fixed Assets)	1,432.0	2,319.5	-	1,440.5	1,634.9
Increase In Investments	0.0	0.0	-	0.0	0.0
Decrease In Investments	0.0	0.0	-	16.7	0.0
Disposal of Fixed Assets	-	-	-	-	-
Net Cash Flow - Investing	1,436.0	2,337.4	-	1,416.4	1,673.6
Net Proceeds From Sale/Issue of Com & Pref	1,285.0	295.7	-	1,865.6	856.6
Com/Pfd Purchased	0.0	0.0	-	0.0	0.0
Long Term Borrowings	10,669.0	6,176.2	-	3,622.7	887.7
Reduction In Long Term Debt	9,871.0	6,087.0	-	1,904.5	203.8
Cash Dividends Paid - Total	0.0	0.0	-	0.0	0.0
Net Cash Flow - Financing	1,529.0	573.8	-	3,744.0	1,523.5
Free Cash Flow Per Share	0.0	(0.0)	(0.0)	(0.0)	(0.0)

All figures in millions of Euro. Growth & ratios are calculated in local currency (U.S. Dollar).

Source: ThomsonOne, 2020

A.6 Tesla - Ownerships Statistics Tesla



Source: FactSet, 31.03.2020

Copenhagen Business School
HANDELSHØJSKOLEN

A.7 Tesla - Top 15 Institutions / Top 5 Insiders/Stakeholders

Top 15 Institutions / Top 5 Insiders/Stakeholders

Rank	Type	%OS	Position (000)	Pos Chg (000) [Recent]	Mkt Val (MM)	% Port	Activism	Report Date	Source
-	Total	46.13	434,410	-54,513	161,913	-	-	-	-
-	Institutions	26.08	245,546	-54,493	91,520	-	-	-	-
1	Capital Research & Management Co. (World Investors)	5.67	53,390	-180	19,900	2.49	Very Low	06/30/2020	13F Form
2	The Vanguard Group, Inc.	4.50	42,370	805	15,792	0.30	Very Low	06/30/2020	13F Form
3	BlackRock Fund Advisors	2.89	27,198	1,465	10,137	0.37	Medium	06/30/2020	13F Form
4	Fidelity Management & Research Co. LLC	2.33	21,957	645	8,184	0.53	Very Low	06/30/2020	13F Form
5	Jennison Associates LLC	2.05	19,344	-2,259	7,210	4.81	Very Low	06/30/2020	13F Form
6	SSgA Funds Management, Inc.	1.68	15,836	356	5,902	0.34	Very Low	06/30/2020	13F Form
7	JPMorgan Investment Management, Inc.	1.17	11,044	-1,456	4,116	0.52	Low	06/30/2020	13F Form
8	Goldman Sachs & Co. LLC (Private Banking)	0.97	9,157	-3,389	3,413	2.39	Very Low	06/30/2020	13F Form
9	BAMCO, Inc.	0.86	8,085	9	3,013	8.43	Low	06/30/2020	13F Form
10	Baillie Gifford & Co.	0.84	7,926	-50,930	2,954	1.11	Low	08/31/2020	13G
11	Geode Capital Management LLC	0.75	7,108	-210	2,649	0.46	Very Low	06/30/2020	13F Form
12	PRIMECAP Management Co.	0.70	6,593	-1,136	2,457	1.91	Very Low	06/30/2020	13F Form
13	Renaissance Technologies LLC	0.59	5,535	1,697	2,063	1.70	Very Low	06/30/2020	13F Form
14	Northern Trust Investments, Inc.(Investment Management)	0.53	5,010	231	1,867	0.31	Very Low	06/30/2020	13F Form
15	TIAA-CREF Investment Management LLC	0.53	4,994	-142	1,861	0.80	Very Low	06/30/2020	13F Form
-	Insiders / Stakeholders	20.06	188,864	-20	70,393	-	-	-	-
1	Musk Elon Reeve	18.11	170,493	65	63,546	100.00	-	02/14/2020	Form 4 Chgs Ben Ownership
2	Ellison Lawrence Joseph	1.59	15,006	6	5,593	7.93	-	02/14/2020	Form 4 Chgs Ben Ownership
3	Straubel Jeffrey B	0.15	1,382	-75	515	100.00	-	07/29/2019	Form 4 Chgs Ben Ownership
4	Valor Management Corp.	0.14	1,344	0	501	48.35	-	02/20/2020	Form 4 Chgs Ben Ownership
5	Musk Kimbal	0.07	638	-16	238	100.00	-	09/03/2020	Form 4 Chgs Ben Ownership

Source: FactSet, 31.03.2020