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Abstract

This thesis examines in detail Tesla's (Tesla, Inc.) business model as well as its business and financial risks in order to build a coherent and robust valuation model to value Tesla's shares as of 30th September 2018. A pivotal role in this regard is detecting the key value drivers in Tesla's corporate operations by understanding how the company generates income and plans to converge its business model to become profitable in the long run. Moreover, an in-depth analysis on various risk factors is conducted to quantify the status quo of Tesla's risk profile. Furthermore, Tesla's capital structure is examined, as well as valuing its hybrid components. To derive Tesla's intrinsic enterprise and equity value, different valuation models are discussed regarding their applicability and the discounted cash flow to firm approach is applied. The thesis shows consequently in detail the derivation of Tesla's equity value per share under different scenarios and reviews the valuation outcomes with a relative valuation approach.

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Firstly, I would like to thank the professors of the University of Vienna for providing a state-of-the-art Finance Masters programme. Particularly, I want to thank Prof. Gyöngyi Lóránth for fostering a corporate finance track in that programme, her dedication for teaching and for supervising this thesis.

Secondly, I want to thank David A. Maier for giving me the chance to gain a foothold in the door in the profession of corporate finance during my studies and waking my interest in valuation.

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Nomenclature

APV	Adjusted present value
$ß_A$	Asset beta
T	average time to exercise or expiry
BCG	Boston Consulting Group
CAPM	Capital Asset Pricing Model
CPU	Central processing Unit
CAGR	Compound annual growth rate
COGS	Cost of goods sold
CRP	Country risk premium
CDS	Credit default swap
S_0	Current stock price
$ß_D$	Debt beta
DOW	Degree of wear
DCF	Discounted cash flow
EBIT	Earnings before interest and tax
EBITDA	Earnings before interest, taxes, depreciation and amortization
EV	Electric vehicle
EV/EBIT	Enterprice value to Earnings before interest and taxes
$ß_E$	Equity beta
K	Exercise or strike price
$ß_F$	Financial risk
FCFF	Free cash flow to firm
GPU	Graphic processor unit
GDP	Gross domestic product
IPO	Initial public offering
ISIN	International securities identification number
LTM	Last twelve months
E	market capitalization
S	Market price
M&A	Mergers and acquisitions
D	Net debt
NOPLAT	Net operating profit less adjusted taxes
NTM	Next twelve months
P/E	Price to earnings
P&L	Profit and loss

R&D	Research and development
r_c	return of the company
rm	return of the market
ROCE	Return on capital employed
r	risk free rate
d_1, d_2	risk-adjusted probabilities
SG&A	Selling, general & administrative
SUV	Sports utility vehicle
g	sustainable growth rate
t_c	tax rate
TV	Terminal value
Q	quarter of a financial year
U.S.	United States
USD	United States Dollar
WACC	Weighted average cost of capital
YTD	Year-to-Date
ZEV	Zero emission vehicle

1 Introduction

1.1 Motivation

The central contribution of this master thesis is addressing the issue if the stock of Tesla, Inc. ("Tesla") is fairly valued by the marked as of September 30th 2018. While B. Cornell and A. Damodaran (2014) find that the stock of Tesla is overvalued by approximately 150% in 2014, this master thesis evaluates if this situation also occurs on 30th September 2018 ("valuation date"), taking into account the latest fundamental as well as market related data of Tesla.

1.2 Research questions

The predominant research question that the thesis tries to assess is:
What is the fundamental value of one share of Tesla's equity as of September 30, 2018?
The following sub-questions ultimately support the main research question and therefore provide an assistance to structure and resolve the research problem:

- What is Tesla's business model and how profitable as well as sustainable is it?
- How competitive is the industry Tesla operates in?
- How might Tesla's market share change in the medium term if well-established car manufacturers enter the market segment in large scale?
- What key business and financial risks need to be considered?
- How do outstanding hybrid securities affect Tesla's equity value?
- How to choose a peer group for a company that has no direct peers offering directly comparable products?
- What is Tesla's status quo regarding its financial position and how to incorporate potential distress effects into the valuation?

Answering those research questions shall ultimately give an indication if Tesla's fundamental value differs from its market valuation at the specified point in time.

1.3 Methodology and structure of the thesis

The research method applied is the case study research method since the thesis analysis a contemporary phenomenon with real world context (Yin, 2014). A substantial part of the thesis focuses on identifying, adapting and applying valuation models that are used in the academic community as well as by professionals. The aim is to customize these general models to optimally fit for the industry, financial condition and life cycle in which Tesla operates. To achieve this goal, a thorough analysis of related literature on already existing Tesla valuations is undertaken. Further, to make this thesis as compact and comprehensive as possible, writing an excessive summary about all available valuation techniques and their historic development is forgone. On the contrary, valuation techniques that are approved and used by both researchers as well practitioners are debated regarding their applicability within the chapters where the actual valuations of Tesla are conducted.

1.4 Limitations and delimitations

All information used in this thesis is publically available since it is not possible to contact Tesla's management regarding internal data e.g. detailed sales and cost breakdowns based on price and volume. Moreover, the basis of available data is considered to be not conclusive to build a fully integrated financial model (Balance sheet, profit and loss statement and cashflow statement fully linked). Furthermore, any pieces of information e.g. financial statements after the valuation date are not considered for this thesis.

The vast majority of processed data is retrieved from the data vendor Standard and Poors, using University of Vienna's student licenses for S&P Global Market Intelligence ("S&P Global") and S&P Capital IQ as well as from Financial Times. Furthermore, all own calculations and own diagrams are performed in Microsoft Excel and the text of the thesis is written in Microsoft Word.

2 Related Research

The development of Tesla's stock price as well as the fundamental value of the stock attracts both researchers as well as practitioners. The most prominent related research is the seminal paper by B. Cornell and A. Damodaran (2014), in which the stock price development from March 2013 until February 2014 is investigated with an event study. By applying a DCF model for the financial years 2013 and 2014 with aggressively optimistic assumptions i.e. 70% annual revenue growth rate over a 10-year forecast-period as well as converging the operating margin that is initially negative to a margin comparable to that of Porsche, the fundamental value of the DCF model amounts to only roughly 40% of the stock price in both years. Cornell and Damodaran conclude that the nearly sevenfold increase in the market capitalization of Tesla between March 2013 and February 2014 not only shows that the stock is vastly overvalued, but also suggests that investor sentiment plays a major role in the price increase and that the significant price rise therefore cannot be explained solely by fundamental data.

B. Cornell (2016) follows up on the previous study of Cornell and Damodaran (2014) and finds that the optimistically chosen growth estimates and assumption about positive operating earnings for the 2014 DCF model are missed significantly in Tesla's latest actual figures. Further, while the stock price declines in the time from March 2014 to June 2016 from $253 to $232 per share, Cornell attributes the price decline mainly to information updates with bad news about the company and therefore implicitly suggests that the stock price does not converge to its fundamental value in the time period from 2014 to 2016.

Cornell's explanations for the consistently overpriced stock are growth options that investors inherently price in. The underlying of these growth options are the promises, smartly delivered by Tesla's charismatic CEO Elon Musk via Twitter, press releases and presentations, that Tesla can deliver a profitable mass marked car in the near future. Cornell concludes that as long as investors continue to believe the "Tesla story", the stock price would remain relatively unaffected by bad news, but argues that an accumulation of bad news could trigger a cascade of doubt regarding the company's fundamentals, ultimately leading to drastic devaluation of the stock.

Other research papers do not directly deal with Tesla's stock valuation but cover complementary aspects that might have an impact on Tesla's valuation. D. Crane (2014) and E. Stringham et al. (2015) focus on Tesla's business model and how the company strategically managed to enter the well-established car industry. Oranburg (2018) coins the term "Hyperfunding" by examining how Tesla funds its productions by pre-selling cars in unprecedented scales.

The price development and fundamental value of Tesla's stock does not only concern the academic community but also experts in the financial industry. D. Dolev and T. Young (2015), both equity research analysts at Jefferies have a price target of $350 in mind for the financial year 2017, while the stock price is at $231 per share when the report was written in May 2015. The basis for their recommendation is a multiple-based approach that is strongly influenced by the assumption that China's demand for electric cars will soar in the years to come and therefore will boost Tesla's EBITDA.

Furthermore, it is worth mentioning that the chosen peer group for this equity research report consists of a total of nine companies of which only three are automotive manufacturers. The other six companies include established tech and high-growth tech companies i.e. Apple and Facebook. Although given that in any Tesla model there is a large proportion of high-end technology, the selection of the peer group remains questionable.

Another equity research report from D. Galves, S. Patil and Y. Babtiste (2016), all three working at Credit Suisse, shows an interesting twist concerning their recommendations: Stock valuations were performed on four different points in time between August 2014 and February 2016 predicting the stock price one year ahead. Starting with a very bullish initial target price of $325 per share in August 2014, the target price was gradually lowered to $240 per share in February 2016. Further, the overly optimistic target price assumptions of the analysts of Credit Suisse proved wrong three out of four times.

One of the more conservative analysts with a more stable price band regarding suggestions is Ryan Brinkman of J.P. Morgan. Brinkman follows the stock since October 2015 and sets price targets between $155 and $200 per share. One exemption was made on August 8th 2018 after the informal announcement that Tesla might be taken private at $420 per share. Brinkman priced in the scenario of a privatization of Tesla with 50% probability, which lead to a target price of $308 per share. Shortly thereafter, as it turned out that the announcement of the privatization was a hoax, he reversed his recommendation. As of October 3rd 2018 his one year price target is $195 per share. Brinkman's valuation method relies on a DCF and multiples-based valuation in equal parts. The peer group chosen for the multiple valuation consists unlike in Dolev's and Young's (2015) only to 20% of disruptive companies i.e. Apple and Google.

Brinkman's calculated WACC is with 14,9% quite high, reflecting an extra risk premium for the US country risk (Brinkman, 2018 a & b). Discounting the one-year price target of $195 per share for one year gives a stock valuation of $170 as of 3rd October 2018. This valuation serves as a first indication of the fundamental value of one share of Tesla's equity as of September 30th 2018 and is to be challenged hereinafter by this master thesis.

3 Company Information and business model

3.1 Corporate information

The first subsection provides detailed supplementary information of Tesla, that does not necessarily affect valuation results, but shall serve as support to develop a holistic view of the company.

3.1.1 Company history and legal basis

The two entrepreneurs Martin Eberhard and Marc Tarpenning founded Tesla Motors back in 2003. The company was established in Palo Alto, California, with the intention to develop electric sports cars. Elon Musk, by then a serial entrepreneur, was one of its earliest financiers in 2004.

Shortly before Tesla released its first fully-electric powered car in 2008, Eberhard and Tarpenning left the company and Elon Musk took over as the CEO (Gregersen & Schreiber, 2019).

Tesla had its initial public offering on 28th June, 2010. The shares are traded on the NASDAQ stock exchange, having the ISIN US88160R1014 (S&P Global, 2019). Therefore, Tesla must not only report under US-GAAP for being incorporated in the United States, but also comply with several securities laws e.g. Securities Exchange Act of 1934, Trust Indenture Act of 1939, Sarbanes-Oxley Act of 2002 and Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010 (SEC, 2019). In this regard, Tesla's audit committee has to appoint an external auditor of a registered public accounting firm to assure its annual financial statements. Tesla's financial year ends as of 31st December and its 2018 financial statements were assured by PricewaterhouseCoopers LLP (Tesla, 2018 a). Beyond that, Tesla has to conduct quarterly reporting of un-audited financial statements as well. All corporate reports and announcements have to be made available to the public through the United States Security and Exchange Commission's EDGAR online database. In addition, Tesla needs its corporate debt to be rated by a rating agency (Securities Exchange Act of 1934). As of 30th September 2018, Tesla has two rating agencies, Standard & Poor's as well as Moody's, assessing its debt (S&P Global, 2019).

3.1.2 Corporate structure and transactions

Tesla, Inc. is a conglomerate with seven direct subsidiaries. Back in 2010, Tesla acquired manufacturing assets, spare parts, facilities and land of New United Motor Manufacturing, Inc. with a total transaction value of 65,2 million USD. In 2015, the board of Tesla decided to start to acquire whole companies that would support Tesla to cope with its high production targets. Rieviera Tool, LLC, a manufacturer and provider of stamping parts was acquired in May 2015, the German Grohmann Engineering GmbH which is specialized on developing automotive assembly systems followed in early January 2017 and Perbix Machine Company, Inc., a specialist in building custom machinery, was acquired in December 2017.
In November 2016 Tesla made its by far broadest acquisition when buying then named SolarCity Corporation with a total transaction value of 6.430,47 million USD. While SolarCity was established in 2006, the company was re-named Tesla Energy Operations, Inc. and has six direct subsidiaries. Its major business segment is producing solar panels for homeowners and businesses.
Further, Tesla, Inc. has two branches in the Europe, one in Switzerland that focuses on marketing, sales and maintenance and one in the Netherlands that produces cars for the European Market (S&P Global, 2019). The following table shows Tesla's corporate structure as of 30th September 2018.

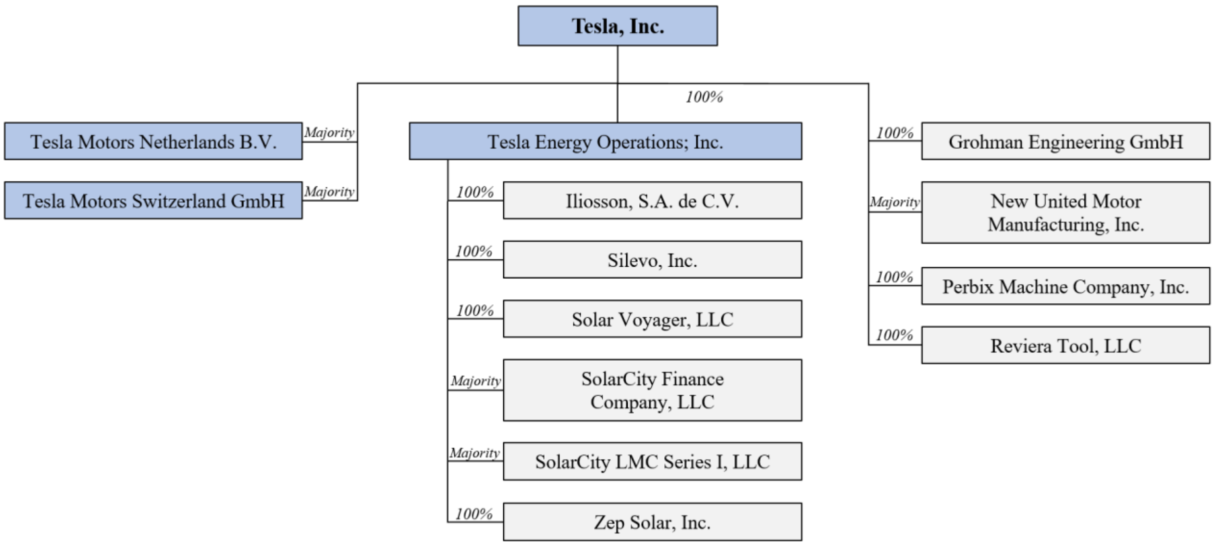

Table 1: Tesla's corporate structure

(S&P Global Market Intelligence, 2019; own research)

3.1.3 Corporate leadership

While Tesla is mostly associated with its current CEO, Elon Musk, the following table summarizes the staffing of key functional roles within the company as of September 30th ,2018. Worth mentioning is that Elon Musk agreed on October 1st ,2018 to step down as Chairman of the board for three consecutive years, following a SEC complaint (Hodgson et al., 2018).

Top Executives:

Name	Role	in position since
Elon R. Musk	Chief Executive Officer	2008
Deepak Ahuja	Chief Financial Officer	2017
Jeffrey B. Straubel	Chief Technology Officer	2005

Board of Directors:

Name	Role	in position since
Elon R. Musk	Chairman of the Board	2004
Antonio Jose Gracias	Lead Director	2010
Elon R. Musk	Board Director/Trustee	2004
Kimbal Musk	Board Director/Trustee	2004
Ira M. Ehrenpreis	Board Director/Trustee	2007
Brad W. Buss	Board Director/Trustee	2009
Stephen T. "Steve" Jurvetson	Board Director/Trustee	2009
Linda Johnson Rice	Board Director/Trustee	2017
James Rupert Murdoch	Board Director/Trustee	2017
Lawrence J. "Larry" Ellison	Board Director/Trustee	2018
Kathleen Wilson-Thompson	Board Director/Trustee	2018

Table 2: People summary

(S&P Global Market Intelligence, 2019; own research)

3.1.4 Corporate ownership

As of September 30th ,2018 Tesla has 171.732.775 shares of common stock outstanding (Tesla, 2018 b). 1091 owners of record had to file their holdings in Tesla stock for legal purposes e.g. via Form 13F, Form 4, etc.

Tesla's by far largest shareholder is its CEO, Elon Musk who holds 33,7 million or 19,7% of common stock outstanding. The largest ten shareholders except for Mr. Musk and Tencent Holdings Ltd. are all investment managers and hold an accumulated proportion of 110,0 million shares or 64,1% of total stock (S&P Global, 2019). *Table 3* summarizes the ten largest shareholders and their respective stakes.

Rank	Holder	Common stock equivalent held	Percentage of common shares outstanding
1	Elon R. Musk	33.737.921	19,6%
2	T. Rowe Price Group Inc.	17.380.054	10,1%
3	Baillie Gifford & Co	13.125.451	7,6%
4	FMR LLC	9.047.746	5,3%
5	Tencent Holdings Ltd.	8.347.094	4,9%
6	Vanguard Group Inc.	7.036.426	4,1%
7	Capital Research & Mgmt Co.	6.817.290	4,0%
8	BlackRock Inc.	6.322.440	3,7%
9	Jennison Associates LLC	4.817.282	2,8%
10	BMO Global Asset Management	3.286.244	1,9%
	Sum	**109.917.948**	**64,0%**

Table 3: 10 largest shareholders

(S&P Global Market Intelligence, 2019; own research)

As of 30th September 2018, Tesla has 128,5 million shares or 74,9% of totals shares outstanding in free float. For the calculation of the free float, the holdings of Tesla's employees i.e. Mr. Musk and other company insiders such as board members are excluded from total shares outstanding. Further, Tencent Holdings Ltd., a Chinese investment holdings company, took a 5% stake in Tesla in March 2017 to break into the electric car market globally (Murgia et al., 2017; S&P Global, 2019). Given Tencent's investment approach and its functional role as adviser to Tesla, its stake in Tesla is considered that of a strategic investor and therefore is excluded from the free float as well.

Figure 1 outlines the respective fraction of fixed ownership to free float and classifies holders of common shares by ownership type.

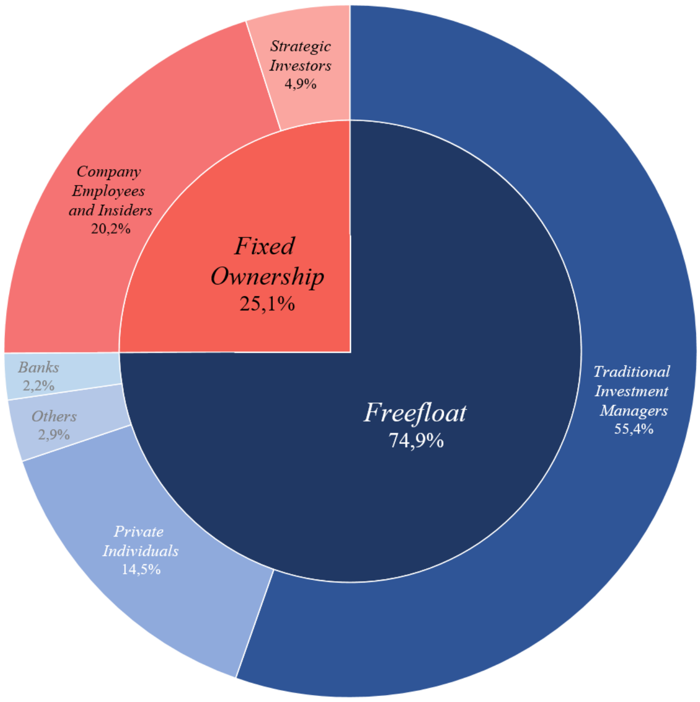

Figure 1: Categorization of Tesla stock ownership

(S&P Global Market Intelligence, 2019; own research)

3.2 Business model

Chapter 3.2 tries to solve foremost one important question: What does Tesla actually do to generate revenues? While this question seems rather trivial, it is concurrently not that straightforward to answer. Tesla has two main business segments: *1.) Electric vehicles* (EVs) *2.) Energy generation and storage systems* (S&P Capital IQ, 2019). Not only the unique product mix of electric vehicles and energy systems makes Tesla very interesting and special company but up and foremost the fact that it produces *only* electric cars, while traditional car manufacturers presently focus mainly on combustion engines and hybrid solutions, gradually adapting their product portfolio to offer EVs.

The output of this chapter shall deliver insights into Tesla's products, technologies as well as its strategy, and serve as a starting point for a later assessment of direct competitors in analyzing industry rivalry, and further assist in the selection of a peer group for valuation inputs. What is more, assessing Tesla's business model can give a qualitative as well as quantitative statement regarding the company's capabilities and long-term performance and thus is a vital component of this thesis.

For starters, it has to be discussed what business models actually are as the literature on business models suggests heterogeneous definitions. Zott et al. (2011) argue that the occurrence of the Internet laid the foundation for an emergence of research on business models since the mid-1990s. Ross et al. (2001) are one of the first to examine how companies migrate their business activities under the influence of new information technologies e.g. Internet and find that businesses adapting to new conditions ultimately have to reinvent their business models too. Johnson et al. (2008) give a very comprehensive definition of a business model: A good business model consists of four interlinked elements that only taken together can create value: *1.) The customer value proposition*, which is simply a business's strategy to create value for its customers by helping to solve problems or get a job done for its clients. *2.) The profit formula* that defines how the company creates value for itself by focusing on the revenue and cost structures of the business. *3.) Key resources* are assets to the company and comprise of people, technology, products, facilities, equipment, sales channels and brands that are necessary to transmit the value proposition to customers. 4.) *Key processes* are metrics that make the value proposition to the customers repeatable and scalable. Key processes comprise components such as design, product development, sourcing and manufacturing, marketing, hiring and training etc.
To analyze Tesla's business model, hence the framework of Johnson et al (2008) is applied.

3.2.1 Customer Value Proposition

One could quickly draw the conclusion, that Tesla creates value for its customers as well as others by producing and selling emission free, clean and green electric vehicles, thereby helping to make cities pollution free and the world a better planet. The ultimate problem with this view is that the origin of energy that is used to power the electric engines of the cars is sourced from battery packs integrated in the EVs. These batteries are charged with energy that needs to be produced somewhere else. A study of Holland et al. (2015) that focuses on the United States finds that the environmental benefit of using electric cars over gasoline cars is on average negative for the U.S. That is because nearly 70 percent of the U.S. electricity is generated by burning natural gas and coal, whereby processing coal produces more emissions than processing oil. Therefore, although marketed as if Tesla's EVs are more environmentally friendly than traditional vehicles with combustion engines, there is until now no clear evidence that proves this proposition.
Where Tesla definitely does a superior job is by marketing the convenience of driving electric cars. While the history of the electric vehicle is retraceable back to the 19^{th} century, there has always been one major problem with electric cars that prevented those from entering the mainstream market: The driving range (Energy, 2019 a). However, that changed when Tesla started to offer its very first electric car, the Tesla Roadster, back in 2008. This car was positioned as a high-end sports car that could easily compete with other gas powered sports cars since it accelerated from 0 to 100 km/h in 3,6 seconds with a top speed of over 200 km/h. The most astonishing fact, though, was the driving range of almost 400

kilometers, while other EVs that emerged from 2009 onwards had a maximum reach of under 150 kilometers (Stringham et al., 2015; Campbell, 2018).

Chen and Perez (2015) identify Tesla's sound knowledge on battery pack systems as one of Tesla's key value propositions. While for the Roadster, Tesla's battery technology was not even that advanced, for its next car generations and storage systems Tesla took a holistic approach by contracting with Panasonic in November 2010 on supplying Tesla with lithium-ion batteries (Soble, 2010). To take their business relation and technological advance to the next level Tesla and Panasonic announced in 2014 to join forces in building a battery cell factory called "Gigafactory" (McGee, 2014).

Müller-Stewens (2018) argues that yet another customer value proposition is Tesla's charging infrastructure. Since 2012, Tesla is globally rolling out its company-owned, self-financed Supercharger stations that enable full coverage regarding recharging possibilities in North America as well as Europe. While it takes over 90 hours to completely recharge the battery pack of any Tesla EV with a standard plug used at home, it takes only 30 minutes to recharge 80% and one and a half hour to fully recharge the battery using the Supercharger network. Tesla owners can also recharge their vehicles at home using a Tesla high-power wall connector which takes them 10 hours to recharge the battery. As of July 2019, Tesla operates 13.344 Superchargers globally and has a huge backlog regarding its network expansion (Tesla, 2019 a). Tesla further experiments with battery swapping technologies that shall complement the Supercharger network.

Andrea Ghizzoni, Tencent's[1] European Director stated in an interview with the Financial Times *"This new generation consists of artificial intelligence and digitizing the physical life of people. Tesla fits well into both. ... They are making digital, intelligent products so it makes sense for Tencent to be there."* (Murgia et al., 2017). A major achievement that satisfies Mr. Ghizzoni's quote is Tesla's autopilot function. In October 2016 Tesla began to equip all its vehicles with a new onboard computer comprising hardware that is crucial for full self-driving, meaning the vehicle can independently drive from point A to B with human oversight (Tesla, 2018 a). Other major car manufacturers as well start providing self-driving technology, but there are different levels of autonomous driving. While a Stop-and-Go Adaptive Cruise Control has as well self-driving components, there are as of 2019 only 16 cars available that provide an appropriate self-driving function, with Tesla having by far the largest road map that supports the autopilot function (Autopilotreview, 2019).

The next question to address is which customers Tesla targets and serves its customer value proposition to. Since Tesla had to enter an established industry with high entry barriers, the initial strategy was to position itself in the premium segment where a company could be profitable on a low sales volume and attract financing by building a proven record of accomplishments (Stringham et al., 2015). Tesla's CEO Elon Musk posted back in 2006 on the company's online blog what he called "Tesla's Master Plan" – Tesla's corporate strategy that became a self-fulfilling prophecy. Musk's summary of that plan is simple but persuasive:

[1] Tencent Holdings Ltd. is a Chinese internet group and strategic investor that has a 5 % stake in Tesla.

"Build sports car – Use that money to build an affordable car – Use that money to build an even more affordable car – While doing above, also provide zero emission electric power generation options" (Musk, 2006). Therefore, having achieved that vision, Tesla's electric cars and products attract customers from the middle and upper class.

3.2.2 Profit formula

This subsection determines in detail with which products and in which geographical areas Tesla generates its current revenues and discusses its associated cost structure. Further, Tesla's margin model and profitability are assessed.

As of 30th September 2018, Tesla generated a total Year-to-Date revenue of 14.235 million USD. These revenues originate from its two major business segments: 1.) Automotive, 2.) Energy generation and storage. *Figure 2* provides a holistic picture of Tesla's revenue streams, associated costs per sub-segment, and gives an intuition on the company's operating profitability.

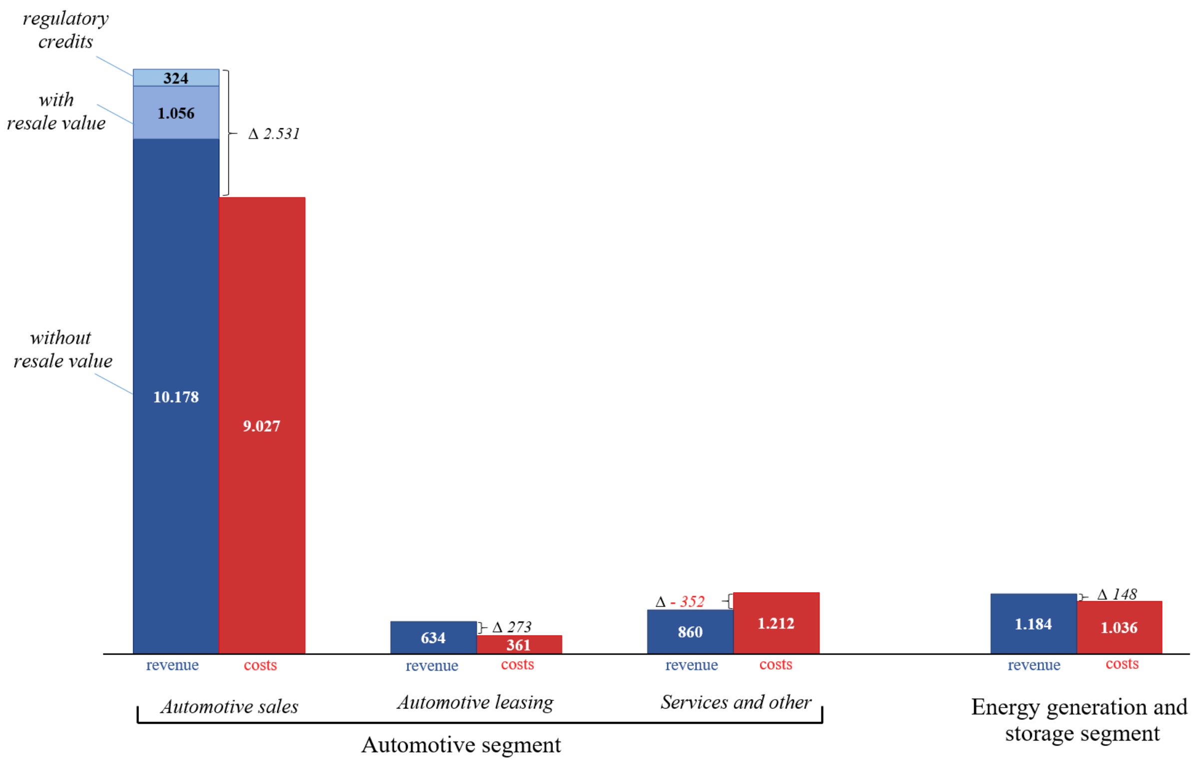

Figure 2: Tesla's revenues and operating costs per segment in million USD as of 30th September 2018 (Tesla, 2018 b; own research)

Out of the 14.235 million USD in total revenue, 13.052 million USD (91,7%) result from the automotive segment. The by far largest value driver as well as the strongest segment in terms of operational profitability is *automotive sales without resale value* with 10.178 million USD (71,5% of total revenue). S*ervices and other* is the only segment that generates an operating loss of 352 million USD, which is due to an increase in costs of new service centers, needed for maintenance of the existing vehicles (Tesla, 2018 b). Tesla has a total operating profitability for the first three quarters of the financial year 2018 of 2.599 million USD.

Figure 3 deals with the geographical spread of total revenue. The by far largest sales market is the United States with a 65,0% market share, followed by China with a 10,2% share.

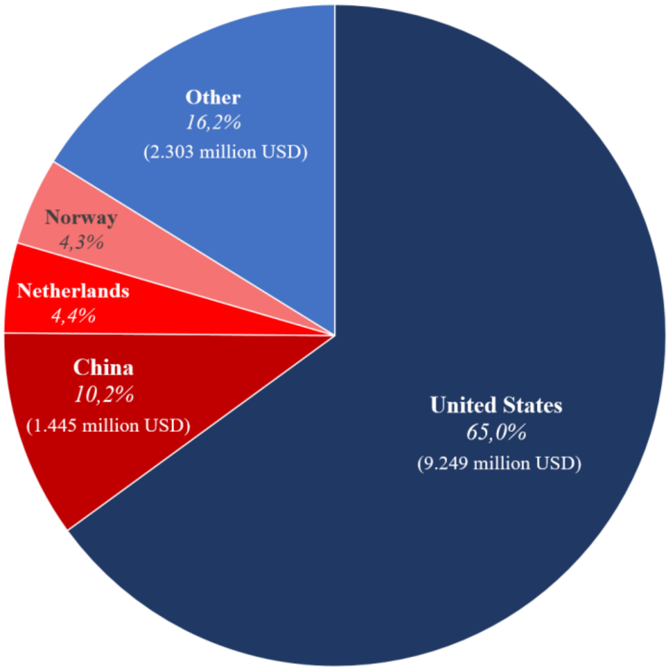

Figure 3: Tesla's geographic revenue distribution as of 30th September 2018

(Tesla, 2018 b; own research)

In the following, Tesla's business segments are discussed to get an intuition for the actual products and services with which the company generates its revenues.

Automotive segment: Tesla currently offers three models of electric vehicles. Pricing of these cars is an ascending function of battery range and electric engine performance. Customers can typically choose between three distinct trim levels: 1.) Standard Range, 2.) Long Range, 3.) Performance;

The Model S, which is a premium sedan, is offered at a price range of USD 65.125 to USD 86.125, the Model X, that is a sports utility vehicle (SUV) is available from USD 71.325 up to USD 92.325 and the Model 3 which is Tesla's answer for the mass market segment is priced in the range of USD 31.225 to USD 51.225 (Tesla, 2019 b).

With the first quarter of the financial year 2015, Tesla began to report the amount of vehicles it had produced and delivered in each quarter. *Figure 4* shows the development of Tesla's car deliveries and therefore sales for each model as a time series from Q1 2015 to Q3 2018[2]. While Tesla kept the deliveries of its Model S and X relatively stable over time with on average proximately 12.500 Model S and 10.000 Model X supplies per quarter, the strongly increasing Model 3 deliveries starting with the financial year 2018 signal an extension in customer targeting away from the pure premium segment to deliver an EV that suits the needs of a broad mass of customers.

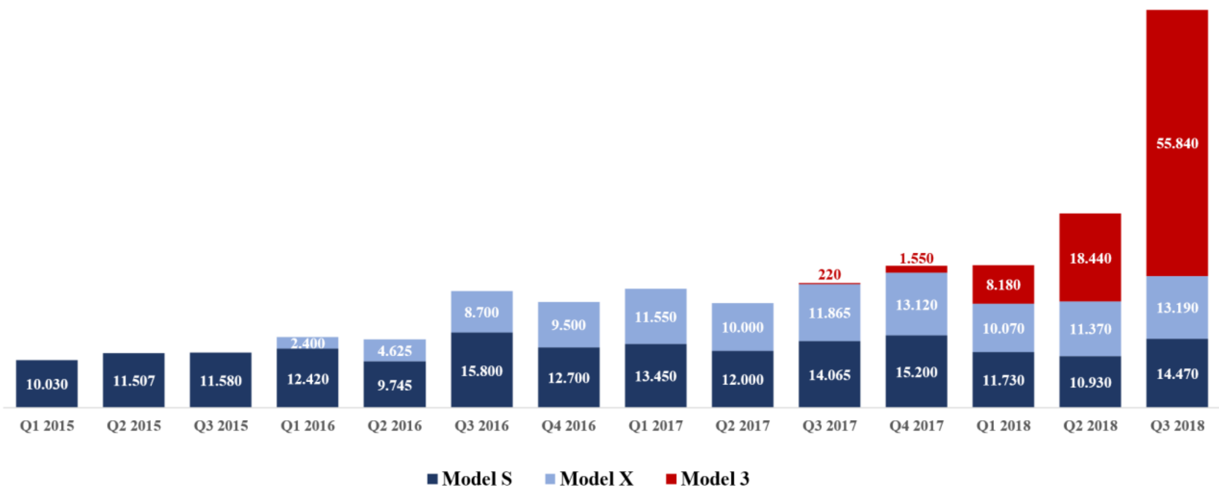

Figure 4: Vehicle deliveries from Q1 2015 until Q3 2018 apiece
(Tesla, 2015 a – 2019 d; own research)

Supplementary to Tesla's existing vehicle portfolio, the company wants to introduce a new version of the Tesla Roadster, a Model Y as well as an electric semi-truck (Tesla, 2018 b).

The revenue category *"Automotive sales"* includes sales of new electric vehicles as well as services such as internet connectivity, software updates and access to the supercharger network. Further, Tesla has its own payment system called "Tesla credits" to pay at supercharger stations (Tesla, 2019 c). There is a further distinction between automotive sales *with* and *without* resale value. While "without resale value" just means that customers finance their cars on their own, Tesla invented back in 2013 what it called a "revolutionary automotive financing product" that defines the revenue category of "automotive sales with resale value". Regarding this, Tesla collaborates with leading banks, which provide 10% of financing for the down payment of any new vehicle. The 10% down payment is refunded by tax savings that are credited when an EV is purchased. After three years the vehicle can but must not be resold to Tesla, which guarantees to buy it back at a pre-specified price (Tesla, 2013).

[2] Tesla did not report the production and delivery figures of Q4 2015.

Besides Tesla's officially marketed financial product, Oranburg (2018) argues that there exists another but hidden financial innovation originated by Tesla, referred to as "Hyperfunding", which Oranburg defines as "fundraising many millions of dollars in a brief campaign that directly targets a broad base of consumers or investors via the internet". While other car manufacturers also rely on down payments, the crucial point with Tesla is that the company presold 400.000 to-be-developed Model 3 vehicles at a down payment of USD 1.000 each, thereby raising USD 400 million in cash. Oranburg argues that it is from a legal standpoint not a down payment since Tesla has an unlimited option to cancel the reservation for the Model 3. Further, the proceeds were not fully used to finance the development of the Model 3 but also the Gigafactory and it remains questionable if raising that much cash without any regulatory filing plays within the legal framework. For the new Tesla Roadster which is currently still under development the company moved the boundaries of the possible even further, requiring a USD 5.000 reservation fee and a USD 45.000 down payment within 10 days. The "Founders Series" of the roadster, which is a limited edition, requires the total price of USD 250.000 to be paid upfront within 10 days from the point of reservation (Tesla, 2019 d).

Tesla developed a side business with *automotive regulatory credits*. Some US states e.g. California have laws in place that require car manufacturers to produce zero emission vehicles (ZEV). Since not all manufacturers can fulfill these requirements and Tesla produces only zero emission vehicles, Tesla can sell excess regulatory credits to other manufacturers. In 2018 Tesla generated year-to-date 324 million USD in revenue from the sale of regulatory credits.

Revenue generated within *Automotive Leasing* originates from direct leasing relationships with qualified customers in North America or from vehicle sales to leasing partners, which provide the leasing contract to end customers. After the contractual leasing period, the leasing partner has the option to sell the car back to Tesla at a pre-specified price.

Within the segment *Services and other* Tesla generates revenues with the repair of defect vehicles and maintenance services as well as sales of used vehicles and vehicle components (Tesla, 2018 b).

Energy generation and storage segment: Tesla designs, engineers and installs solar energy and energy storage systems. The buyers of that segment's products are categorized as residential as well as small and large commercial customers. While residential customers have to pay the full purchase price for a solar energy-system up front, commercial customers make payments depending on the progress of the installation of a solar system. Tesla offers as well to lease energy generation and storage systems in which case customers pay for the generated electricity (Tesla, 2018 b).

When it comes to the discussion of the overall profitability of Tesla's business model, a breakdown of the profit and loss statement (P&L) year-to-date for the financial year 2018 gives the following decomposition as shown in *Figure 5*. In the first three quarters of 2018, Tesla has a cumulative net loss of 1.237 million USD. The major driver for that result is what Tesla refers to as "total cost of revenues" which is actually cost of goods sold (COGS), comprising of all costs that are directly associated with manufacturing as well as depreciation. Further substantial cost positions include selling, general and administrative expenses (SG&A) and research and development expenses (R&D). SG&A expenses cover mainly personnel and facilities costs as well as marketing expenses, executive remuneration, fees for consulting services and litigation settlement costs. R&D expenses comprise likewise personnel costs for engineers, prototype costs and fees for professional services (Tesla, 2018 b). It is worth mentioning that Tesla reports in other income/expenses gains and losses from foreign exchange transactions as well as changes in fair value from interest rate swaps, which is an acceptable approach. In any case, other income/expenses then belongs to the financial result (Barnes et al., 2019).

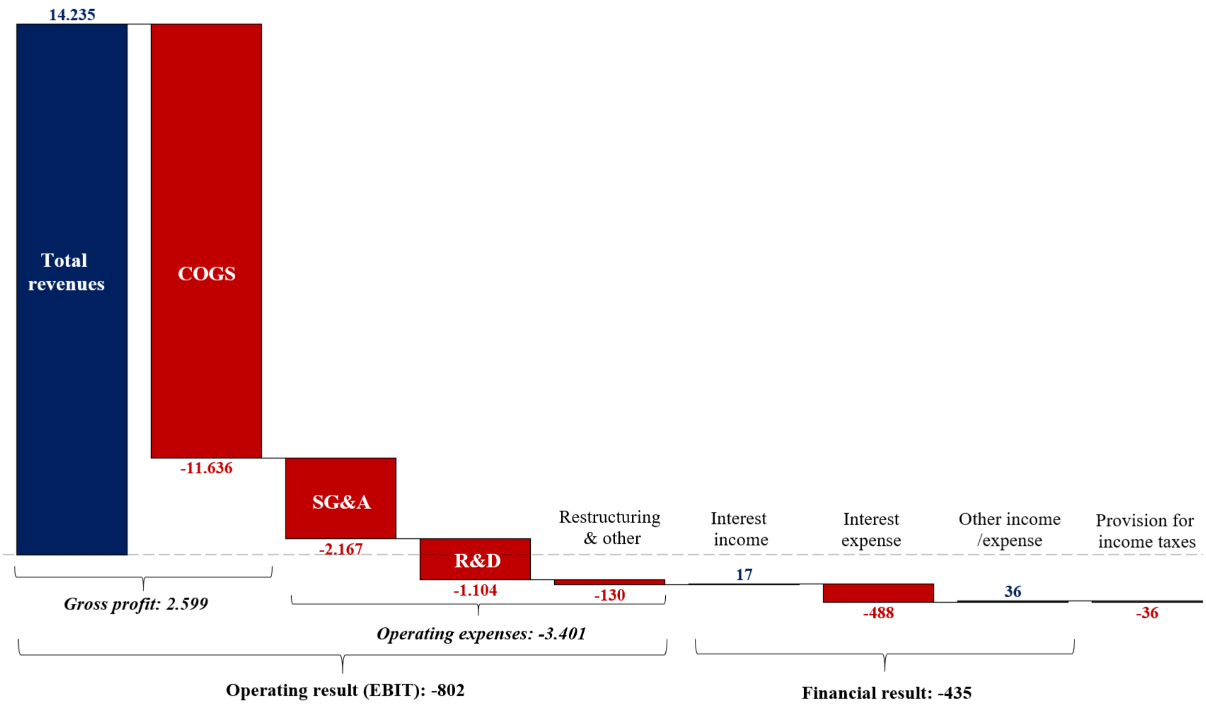

Figure 5: Decomposition of Tesla's P&L YTD 30.09.2018 in million USD (Tesla, 2018 b; own research)

Figure 5 can even be interpreted as graphical common size analyses, where line items are given as a fraction or percentage of e.g. total revenue. Preparing a common size income or balance sheet statement makes not only sense for detecting questionable items, but also simplifies the comparison among companies (Penman, 2013).

To examine Tesla's profitability from a different perspective, Tesla's P&L is subsequently compared to Ford Motor Company's ("Ford"). The intention of this undertaking is to compare the cost structure of Tesla as a young, high growth company to that of a well-stablished, mature company and thereby emphasizing potential inefficiencies that Tesla has to overcome in order to become profitable. Whereas it can be argued that Ford is not a direct peer to Tesla because of its advanced stage in the company life cycle, having approximately 8,8 times Tesla's company size in terms of total assets[3], Ford is subjected to similar business risks, selling comparable products to a widely homogenous group of customers in similar geographical regions. Moreover, since both companies are incorporated in the US, both have to report under US GAAP, which eliminates accounting differences such as revenue recognition and ensures a high degree of comparability regarding the structure of the P&Ls.

Common size P&L	**TESLA** YTD *30.09.2018*	**FORD** YTD *30.09.2018*	**difference**
Total revenues	100,0%	100,0%	0,0%
Cost of goods sold	-81,7%	-90,3%	-8,6%
Selling, general and administrative	-15,2%	-7,1%	8,2%
Research and development	-7,8%	-0,1%	7,7%
Restructuring and other	-0,9%	0,0%	0,9%
Interest income	0,1%	0,8%	0,6%
Interest expense	-3,4%	-0,8%	2,6%
Other income (expense)	0,3%	1,2%	1,0%
Provision for income taxes	-0,3%	-0,5%	-0,2%
Gross profit margin	18,3%	9,7%	-8,6%
EBIT margin	-5,6%	2,5%	8,1%
Net profit margin	-8,9%	3,2%	12,1%

Table 4: Comparison of Tesla's P&L to Ford's YTD 2018

(Tesla, 2018 b; Ford, 2018 b; own research and calculations)

Table 4 depicts income and costs as percentage of total revenues for both Tesla and Ford. To make the comparison as accurate as possible, some subheadings of Ford's P&L are reclassified to best match the P&L structure of Tesla [4]. The calculations of gross profit, EBIT and net profit margin are based on the following formulas [5].

$$Gross\ profit\ margin = \frac{Gross\ profit}{Total\ revenues} = \frac{Total\ revenue - COGS}{Total\ revenues} \tag{1}$$

$$EBIT\ margin = \frac{EBIT}{Total\ revenues} = \frac{Gross\ profit - operating\ expenses}{Total\ revenues} \tag{2}$$

$$Net\ profit\ margin = \frac{Net\ income}{Total\ revenues} = \frac{Operating - Financial\ result - Tax\ provision}{Total\ revenues} \tag{3}$$

Though Tesla has a quite high gross profit margin of 18,3% compared to Ford's of 9,7%, the EBIT margin is negative with -5,6%. The major reason for this finding is that Tesla spends more than twice

[3] Tesla's total assets as of 30.09.2018: 29.263 million USD,
Ford's total assets as of 30.09.2018: 258.966 million USD;
[4] All adjustments to Ford's P&L are depicted in *Appendix 1*
[5] Adapted from *Rosenbaum & Pearl (2009)*

as much on SG&A than Ford does. Moreover, significant R&D spending can be interpreted as a good sign, given that Tesla develops highly technical and disruptive products, but Tesla's R&D spending is way far off compared to Ford's. Both, SG&A as well as R&D spending as fraction of total revenue might have the potential to be decreased in the future, once the production of electric vehicles is on a higher level and economies of scale begin to materialize.

3.2.3 Key Resources

This paragraph discusses the necessities of Tesla to be able to develop and manufacture its products and deliver its customer value proposition. Some noticeable key resources contain Tesla's workforce, its factories, strategic alliances as well as its distribution network.

Tesla's CEO, Elon Musk is very careful when it comes to recruiting staff. If he were not able to find suitable employees, in the worst case he would not hire anyone at all. An extreme situation occurred at SpaceX, a private US aerospace enterprise that Musk founded. As he was unable to recruit a suitable candidate for chief engineer and chief designer, he took over both positions and holds them all along (S&P Capital IQ, 2019 & Clifford, 2017).

The hiring process to work for Tesla in a lot of roles is structured in a way that before signing the contract, Mr. Musk holds a personal interview with the candidate (Cain, 2017). The whole Tesla culture is set up to deliver a start-up like feeling although almost 38.000 full-time employees worked for Tesla globally in 2017 (Müller-Stewens, 2018 & Tesla, 2018 a). Since Musk expects employees to cope with heavy workload, they are working a minimum of 50 hours a week. Therefore, the fluctuation is high and retaining talent is a challenging task. Moreover, turnover at the executive level is considerably high. From 2003 until 2018, a total of 34 top executives terminated their contracts and another 19 professionals in leading functions quit. Alone year-to-date 2018, one of Tesla's most controversial years, five top executives left the company as shown in *Table 5*. This definitely is a bad sign and stresses the functioning of Tesla's business model.

Top Executives	Position	Time in the company
Jayaprakash Vijayan	Former Chief Information Officer	01/2012 - 01/2016
Jason S. Wheeler	Former Chief Financial Officer	11/2015 - 02/2017
Gary Clark	Former Chief Information Officer	02/2017 - 06/2017
Diarmuid B. O'Connell	Former Vice President of Business Development	2006 - 02/2018
Eric Branderiz	Former Chief Accounting Officer	08/2016 - 03/2018
John Douglas "Doug" Field	Former Senior Vice President of Engineering	09/2016 - 06/2018
David H. "Dave" Morton Jr.	Former Chief Accounting Officer	08/2018 - 09/2018
Gabrielle Toledano	Former Chief People Officer	05/2017 - 09/2018

Table 5: Top executives leaving Tesla 2016 – 2018

(S&P Global Market Intelligence, 2019; own research)

Another key resource is Tesla's production facilities. The company currently operates four factories: *Tesla Factory*, *Tesla Gigafactory 1 and 2* as well as a factory in the *Netherlands;*
The factory in the Netherlands mainly executes assembling of car parts to deliver finished electric vehicles to customers in the European market. The *Tesla Factory* produces the majority of vehicle components for all models and assembles them for the US and Asian market and is located in Freemont, California. Both Gigafactories are joint ventures with Panasonic. They are already in operation but not fully completed since the start of the constructions was in 2014 and 2016 respectively. These factories produce mainly battery packs and energy storage products as well as solar panels. Furthermore, Gigafactory 1 builds electric engines for the model 3 (Tesla, 2018 a, b & 2019 e).
With the battery pack being the second most expensive component in an electric vehicle, Tesla made sure to secure its demand for necessary components. The company has negotiated with Panasonic to have the right to purchase the full output produced at Gigafactory 1 at a pre-specified price and has a 10-year contract to purchase a certain quantity of photovoltaic cells and modules from Gigafactory 2 (Statista, 2019 & Tesla, 2019 b). To secure the supply of lithium hydroxide, an integral part for battery production, Tesla entered in August and September 2015 into two five year supply agreements with an investor group consisting of Bacanora Lithium Plc, Cadence Minerals Plc and the company Pure Energy Minerals Limited, respectively. In May 2018 Tesla signed a contract with Kidman Resources, an Australian lithium miner, to supply Tesla for three years with the valuable resource (Sanderson, 2015 & 2018; S&P Global).
For the matter of *distribution,* Tesla relies on its own sales network. There are no authorized distributors but only stores, directly operated by Tesla. Products are bought online or via the stores (Tesla; 2019 f).

3.2.4 Key Processes

Tesla is outstanding when it comes to *market* its products. Instead of focusing on traditional advertising channels, it uses primarily media coverage and word of mouth. The result of that strategy is that in 2017 Tesla spent 66,5 million USD for marketing and advertising, which is 0,47% of total revenues for that year. Ford, on the other hand, spent 2,62% of revenues on marketing in the same time period (Tesla, 2018 a & Ford, 2018 a).
Mangram (2012) draws a comparison of Tesla's branding strategy to that of Apple's with the Mac and iPod. Tesla seems to have created a "technology hub" strategy whereby the attention of the electric vehicles help to cross-sell energy generation and storage products and vice versa since these products are complementary to each other. Further, Tesla's brand value is subject to reinforcing processes through news channels and brand rankings.
Another major driving force for Tesla's branding success is undoubtedly its CEO, Elon Musk. Having an unbroken record of accomplishments regarding successful investments and business creations, Musk has a reputation as being an unstoppable game-changer and disruptor of whole industries (Yoshaei,

2018; S&P IQ, 2019). Being aware of that fact, Musk leverages his reputation on the social media channel "Twitter", reporting personal opinions and even corporate information of his enterprises (Musk, 2019).

Key processes that are currently subject to major changes and constitute a big challenge for Tesla are *manufacturing* and *logistics*. The reason for that is that Tesla tries to scale its electric vehicle production output at a tremendous pace, leading over from small-scale to mass production. Musk fittingly named the state "production hell", as Tesla had to cope with an order backlog of 500.000 Model 3 EVs mid-2017 (Downes & Nunes, 2017). While Tesla targeted an output rate of 5.000 Model 3 vehicles per week for the year-end of 2017, in April 2018 it struggled to produce 2.000 model 3 EVs per week (Bradshaw, 2018). It was only in June 2018 that Tesla surpassed its production target of 5.000 vehicles per week, reaching a record of 5.200 Model 3 EVs at the last week of the quarter 2018. After managing to overcome its production issues, Tesla faced logistical problems to deliver its finished cars, pushing back delivery dates many times. (Shaban, 2018; Tesla, 2018 g).

3.2.5 Conclusion and outlook

There are different views on the sustainability of Tesla's business model with Bartmann (2015) declaring that Tesla should focus on the premium segment due to less rivalry and fewer hurdles to scale the business. Downes & Nunes (2017) argue that although Tesla disrupted the transportation industry, it lacks the financial resources to become the electric vehicle industry leader, having other competitors waiting in the pole position to enter the EV segment. Knight (2016) to a certain extent agrees to that view, arguing increased competition would be one of Tesla's biggest challenges to come. However, Tesla has the strategic advantage of being more aggressive regarding the adaption of new technologies since rigid, long-established car companies have higher development times for their vehicles and are risk averse when it comes to implementing new features and technologies.

It is challenging to argue for or against the sustainability of Tesla's business model. Tesla clearly operates in a high-risk environment, being a technology leader and real first-mover in the electric vehicle market. The technology of its vehicles as well as the holistic concepts regarding product integration makes it tremendously hard to categorize Tesla into one industry and to find similar companies.

Further, Tesla currently scales its business aggressively by trying to establish a mainstream brand. It oftentimes operates its resources to the limit, leaving literally no margin for error. However, Musk has maneuvered all his enterprises with distinction over all obstacles. Therefore, with the current business model, being on the verge to break even with a profit in the third quarter of 2018, gives the impression to be effective in the mid run once production has stabilized at a higher target level than current.

The question is what to expect next. In the medium term, increased competition in the electric vehicle as well as autonomous driving segment seems highly probable. However, Musk has an answer regarding Tesla's future, which he wrote on the company's blog 10 years after he revealed his first "master plan" in 2006. Tesla's strategy for the future according to Musk is to further integrate energy generation and storage, delivering a product that combines all needs and makes users independent from external energy sources. Regarding transportation, Tesla wants to broaden its approach and enter the cargo transport segment with a Tesla truck called "Semi". Nevertheless, the Holy Grail in transportation seems to be autonomous driving. While the current Tesla vehicles support autonomous driving with human oversight, Musk thinks ahead and wants to build vehicles that are operable by children without any human intervention. Once the technology is ready and approved by regulators Tesla owners might rent their vehicles to others under a car-sharing contract, earning money passively (Musk, 2016). While this all might sound like dreams of the future, no one would have imagined a view years ago that Tesla would outsell long-establish car manufacturers Mercedes-Benz and Audi in the US in the third quarter of 2018, proving that Tesla can get it right (Su, 2018 b).

4 Risk assessment

This chapter builds on the previous one, taking the analysis from plainly understanding *how* Tesla operates towards identifying potential risk factors that could harm the viability of Tesla's business model. The key question to ask in this section to identify risks is "What could potentially go wrong?"

While there are many frameworks to cluster risks such as e.g. Porter's Five Forces, SWOT analyses, PESTEL analysis etc. a differentiation between *business* and *financial* risk might be most suitable for valuation purposes. That is because individual risk factors of Tesla can be adapted and considered more precisely as well as a quantitative comparison to competitors is feasible.

First, to derive the individual components of business and financial risk it is necessary to introduce superordinate risk categories. Sharpe (1964) found that any company or asset faces systematic and unsystematic risks. Systematic or non-diversifiable risks are hazards that influence a whole industry i.e. lithium prices for batteries increase drastically, and therefore will move the stock prices of many companies if lithium is a necessary raw material for production. However, unsystematic or idiosyncratic risks are risks that are company-specific, i.e. if a fire destroys Gigafactory 1 only Tesla will absorb the loss. Therefore, as it is assumed in modern portfolio theory that investors hold not only one stock but a portfolio with various asset classes that counterbalance individual losses and therefore diversify idiosyncratic risks, risk premiums for unsystematic risks do not need to be priced in.

Having only systematic risk left to consider, an integral part in any valuation is to *measure* risk. A company's exposure to systematic risk can be expressed using a beta factor ($ß_E$). Having a company with a beta equal to 1 suggests that if the whole market or in particular the underlying index moves up e.g. 1%, the stock price of that company as well rises by 1% (Berk and DeMazo, 2017). Beta therefore measures the co-movement of the return of a stock with the return of the market. *Formula 4* expresses that relation with r_M being the return on of the market and r_C the return of the company (Welch, 2017).

$$\beta_E = \frac{Cov\ (r_M, r_C)}{Var\ (r_M)} \tag{4}$$

Systematic risk consists of business risk and financial risk. While business risk depends solely on the company's operating activities and is independent from any financing decision, financial risk is an ad on to business risk that originates from debt financing or more specifically the choice of the capital structure. The more a company levers up, the more risk do equity holders have to bear. Therefore, equity holders need to be compensated for extra risk that arises from adjustments in the capital structure away from a purely unlevered company (Gabriel and Baker, 1980; Ross et al, 2017).

Business risk can be measured by un-levering the beta factor and comparing it to the beta factor of an industry or competitor. The levered beta or equity beta ($ß_E$) has to be greater than the unlevered beta or asset beta ($ß_A$) since it incorporates also financial risk. In the literature on betas there are various different approaches to calculate the asset beta. The main difference between the concepts is whether a company maintains a constant leverage ratio and if it is assumed that the debt of that company is risky. If the debt is risky, an additional debt beta ($ß_D$) has be considered (Fernandez, 2008). In the case of Tesla, with a Standard & Poor's issuer credit rating of B-, it is reasonable to incorporate a debt beta. The most appropriate formula that incorporates a $ß_D$ and which is also widely accepted and used by practitioners is that of Harris and Pringle – *Formula 5* (Enzinger, 2019). Further, since one of the major goals of this chapter is to provide a risk comparison by applying the same method of calculation to Tesla's competitors as well, to assure optimal comparability choosing an approach for a constant debt-to-equity ratio makes sense for long established competitors in the car industry.

$$\beta_A = \frac{E * \beta_E + D * \beta_D}{E + D} \quad (5)$$

Where *E* is the market capitalization of the company under consideration and *D* is the amount of net debt. Since *E+D* represents a company's enterprise value, excess cash and short term investments have to be deducted from debt outstanding in order to obtain net debt (Berk and DeMarzo, 2017).

The final fragment left to consider is the derivation of the debt beta. While there exist methods that are quite sophisticated, e.g. dividing the credit spread of a company over the market risk premium of the underlying index to calculate the debt beta (Aschauer and Purtscher, 2011), Berk and DeMarzo (2017) provide a mapping between the debt rating and debt beta. Using that alternative might be a wiser choice for deriving debt betas for comparison purposes since otherwise it takes considerable efforts and is prone to error susceptibility when calculating weighted debt yields for various outstanding securities. *Table 6* provides the mapping of rating classes and debt betas. The given debt betas were further linearly interpolated to account for each subcategory of rating.

Description	S&P debt rating	debt beta	interpolated debt beta
Highest quality	AAA		0,010
High quality	AA +		0,012
	AA		0,013
	AA -	< 0,05	0,015
Strong payment capacity	A +		0,017
	A		0,018
	A -		0,049
Adequate payment capacity	BBB +		0,074
	BBB	0,10	0,100
	BBB -		0,123
Likely to fulfill obligations, ongoing uncertainty	BB +		0,147
	BB	0,17	0,170
	BB -		0,200
High credit risk	B +		0,230
	B	0,26	0,260
	B -		0,277
Very high credit risk	CCC +		0,293
	CCC	0,31	0,310
	CCC -		0,327

Table 6: Debt ratings and related debt betas

(Berk and DeMarzo, 2017 & S&P Ratings, 2019 & Afonso et al., 2006; own calculations)

Financial risk (defined as β_F) a fortiori is the difference between total systematic risk and business risk as expressed in *Equation 6*.

$$\beta_F = \beta_E - \beta_A \tag{6}$$

4.1 Business risk

This section identifies and describes significant business risks Tesla is confronted with and compares the asset beta to that of its direct competitors to assess the riskiness of Tesla's operations and business model. Since more than 90% of Tesla's revenue is generated from the automotive segment, any business related risk in that field might have a significant overall impact on the course of business. Therefore, the following analyses focuses purely on the automotive segment, except for calculating the asset beta.

4.1.1 Competition

A mayor risk regarding Tesla's future profitability could arise from an increase in competition in the automotive segment. To identify Tesla's current direct competitors, it is most reasonable to first analyze global electric vehicle sales for the year 2018. With plug-in-hybrid cars having both an internal combustion engine as well as an electric engine, it is justifiable to consider these cars competitors to pure electric vehicles. *Figure 6* shows that Tesla currently is the market leader in the electric vehicle and plug-in-hybrid segment having the best-selling electric vehicle globally, the Tesla Model 3, with almost 150.000 sales in 2018. While Tesla faces strong competition in the EV segment on eye level with companies such as Chinese BAIC Motor Corporation Limited, there is as well business rivalry with established car manufacturers across segments. Furthermore, in the entry-level premium sedan market, Tesla competes against vehicles with combustion engines from carmakers such as Audi, BMW, Lexus and Mercedes (S&P IQ, 2019; Tesla, 2019 b).

A major threat for Tesla is that titans such as Audi, BMW or Volkswagen, etc. with stronger sales networks as well as advanced financial and technical resources enter the electric vehicle segment on large scale at more competitive prices, putting not only Tesla's margin model to the test but skimming market share and therefore sales.

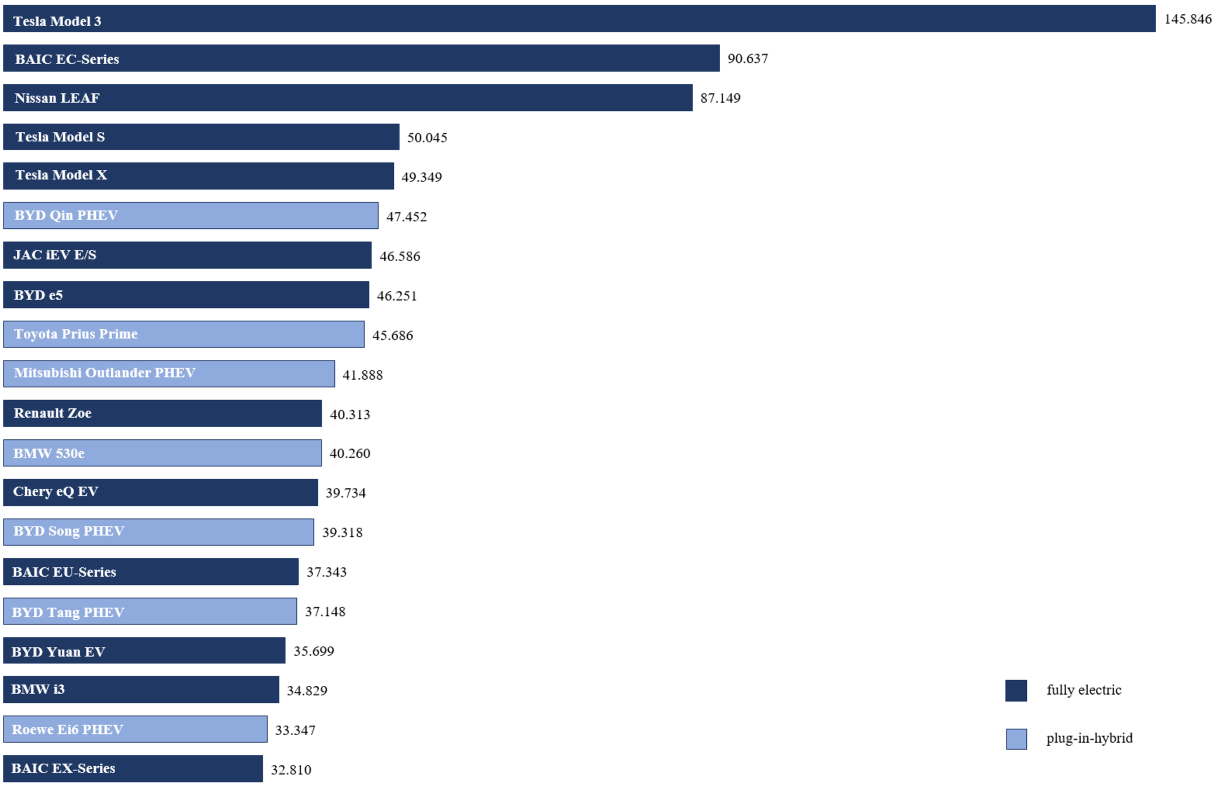

Figure 6: Global top 20 best-selling electric and plug-in-hybrid vehicles of 2018 (Shahan, 2019; own graph)

BMW started to sell electric vehicles in 2017 and plans to roll out 25 EVs and hybrids by 2025. To reach that goal, R&D expenditure for 2018 is planned to be up 0,8% compared to 2017, totaling 7% of revenues (BMW, 2018; McGee 2018 a). Volkswagen, the world's largest car manufacturer in 2018 based on unit sales, has even more ambitious plans. The parent company of the brands Audi, MAN, Porsche and VW, seeks to be market leader in electric mobility by 2025. To reach that goal, the corporate group plans to invest 50 billion Euros into battery development in the next years coming and wants to have 80 electric and plug-in-hybrid vehicles ready for the market by 2025. The group plans to offer for each of its petrol- and diesel-driven cars in its portfolio, which comprises of roughly 300 vehicles, an alternative with an electric power unit by 2030. Furthermore, Volkswagen entered in 2017 into a joint venture with the Chinese car manufacturer Anhui Jianghuai Automobile (JAC) to accelerate its business activity in the EV segment in China (Volkswagen 2017 & 2018; Richter, 2019).

However, not only traditional car manufacturers pose competition to Tesla. When it comes to the technology development of self-driving vehicles and connecting cars to the internet using cloud technology, also high-tech companies such as Apple, Intel, Microsoft and Google intensify their efforts to stay up to speed by joining their forces with established car manufacturers. Microsoft collaborates with Volkswagen on cloud technology, while Google found the company WAYMO that focuses entirely on autonomous-driving and has a partnership with Jaguar (McGee, 2018 b; WAYMO, 2019). Moreover, Intel, best known for building central processing units (CPUs) for computers, focuses in the course of corporate restructuring heavily on autonomous driving by joining forces with BMW (Bajpai, 2019).

Tesla had a three-year contract with Nvidia, a graphic processor unit (GPU) producer but dropped their agreement to develop its own hardware for the autopilot function (Su, 2018 a). The advantage of that development is that Tesla is no longer reliant on any supplier, though it might suffer severe competition from high-tech companies with superior capabilities, financially as well as in terms of experience.

4.1.2 Industry outlook

With increased competition and therefore supply of electric vehicles, a fundamental question to address is how the market share of electric vehicles in the future might evolve. Research from the Boston Consulting Group (BCG) forecasts that until 2030 there will be a strong trend towards pure electric vehicles and hybrids. *Figure 7* shows that transition, with gasoline and diesel powered vehicles decreasing from 76% and 19% in 2017 to approximately 47% and 5% respectively by 2030. However, the market share of pure electric vehicles with battery packs is expected to rise from 1% in 2017 to 14% by the year 2030 (Mosquet et al., 2018). The by far stronger growth forecast for diverse hybrid vehicles suggests that there will not be a radical shift from gasoline or diesel to only electric vehicles in the near future, but a transition using the best out of both worlds might be the mainstream solution.

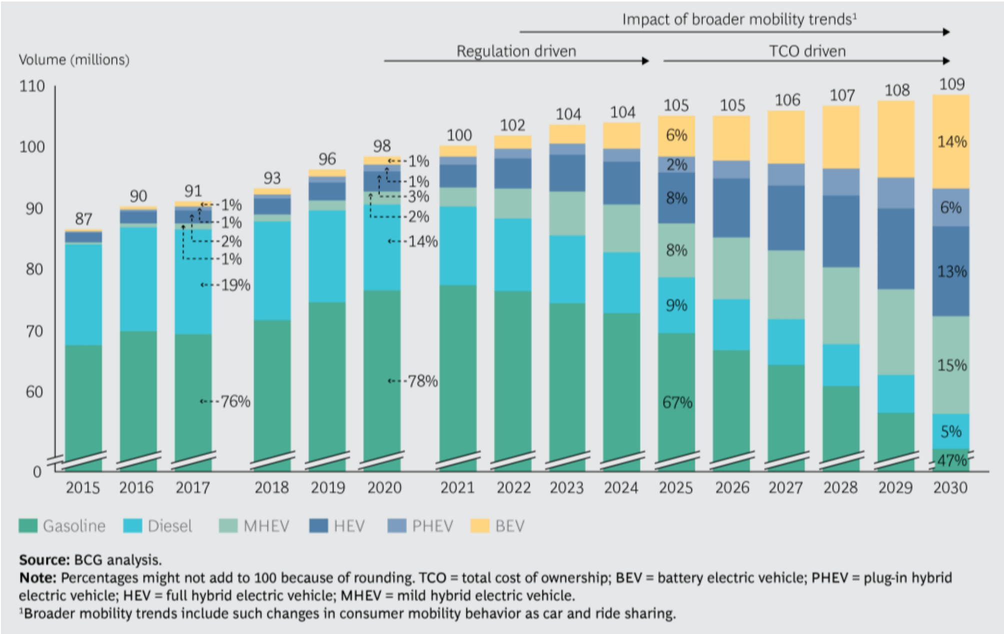

Figure 7: Global car sales by fuel source through 2030
(Mosquet et al., 2018)

Another important view on the expansion of market share in the electric vehicle segment is the geographical development. China seems to be one of the most lucrative target markets to come in the next few years. Having rigorous restrictions in place for buying and driving new gasoline or diesel-powered cars in urban areas, China is the fastest adopter of electric vehicles. By 2025, China might account for half of the global disposals of EVs (Beale, 2018). *Figure 8* deploys that Europe as well as the United States of America are expected to intensify electric mobility at a later stage but remain the target markets slightly behind China in the long run.

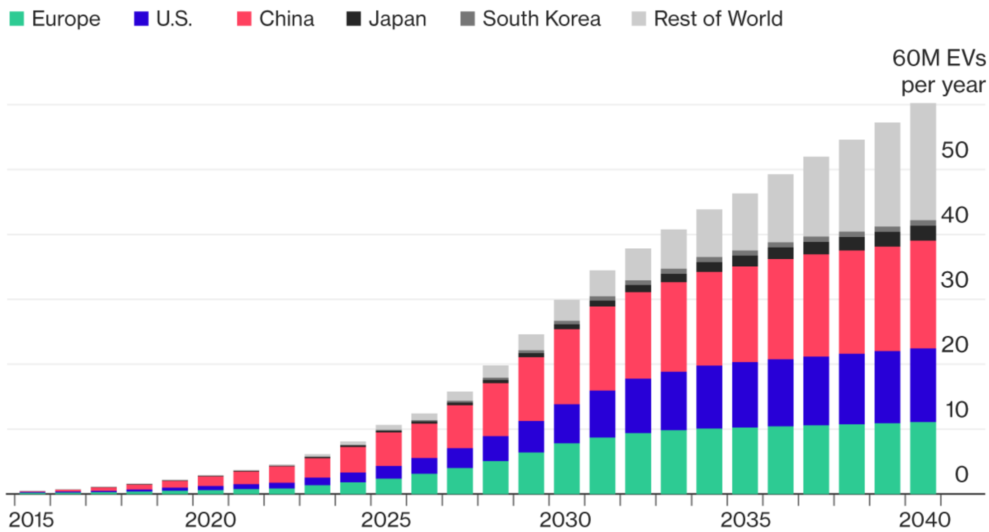

Figure 8: Global geographical electric vehicle trend (Bloomberg, 2018)

4.1.3 Overall economic development

Any company's or industry's growth prospects in the end might be limited by a country's or market's overall economic growth. Therefore, by assessing a country's expected future expansion, measured in e.g. gross domestic product (GDP) constitutes an upper limit for long run profitability of any company and industry (Koller et al. 2015). *Figure 9* shows the annual percentage change in real GDP growth for Tesla's core markets as well as Europe and the world until the year 2024. Both Europe and the U.S. are expected to grow steadily from 2022 onwards at 1,6% to 1,7% per anno. China's GDP is expected to decrease gradually from 6,3% in 2019 to 5,5% by the year 2024. However, overall economic growth is expected to increase slightly.

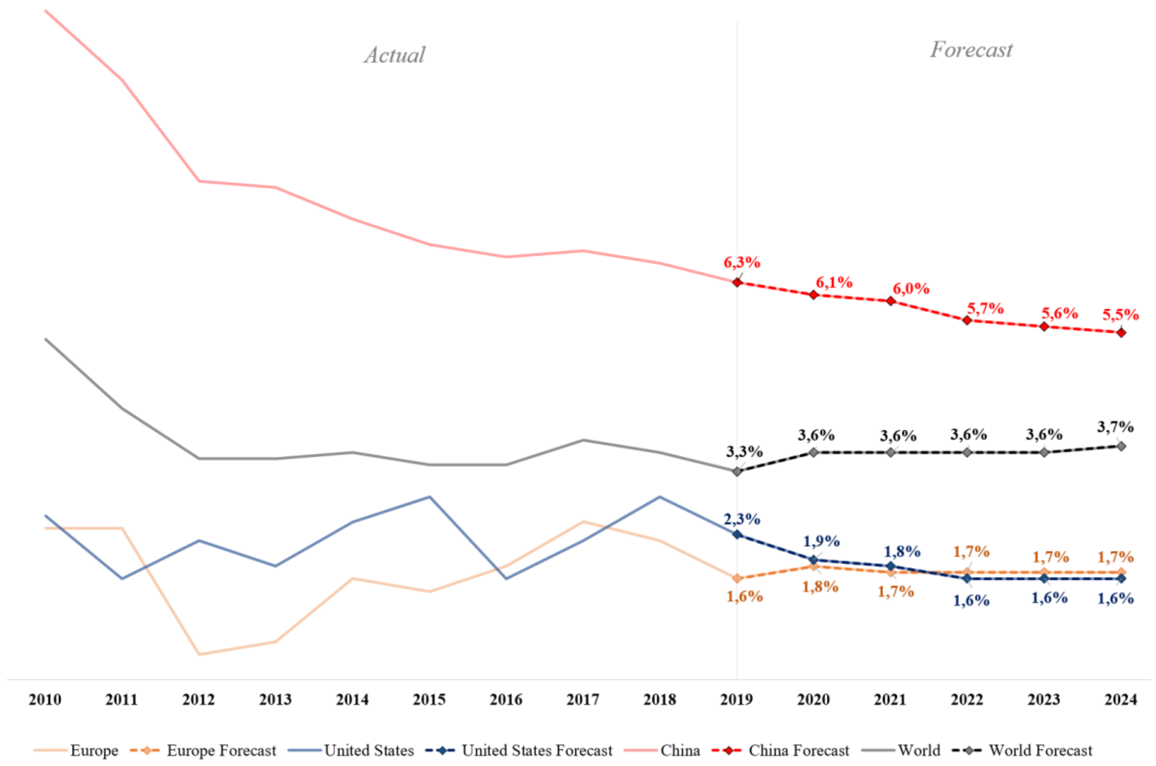

Figure 9: Actual and expected real GDP growth in percentage per year
(IMF, 2019; own data processing and research)

4.1.4 Sensitivity to the business cycle

There are different methods to measure if a company is exposed to business cyclicality. First, a plain but effective method is to analyze e.g. annual sales growth in percentage and potentially detect trends and fluctuations in the time series (Bodie et al., 2017). To examine if there are any seasonal trends in the sales i.e. assuming purchasers of Tesla electric vehicles buy with higher probability in spring, sales figures are examined on a quarterly basis for that reason.

Another essential evaluation when it comes to measure a company's vulnerability to business cycles is its operating leverage, which is the proportion of fixed to variable costs. Having high fixed costs compared to variable costs results in a high operating leverage and therefore high asset beta. The problem with high fixed costs is that these cost type occurs regardless of the output level, leaving companies with a high operating leverage more vulnerable to economic downturns and therefore business cycles if sales decline, since their cost structure cannot dynamically adapt to new economic conditions in the short run (Brealey et.al., 2011). *Figure 10* displays the quarterly percentage change in revenue as well as the fraction of operating leverage over time. Since Tesla does not explicitly report fixed and variable costs in its P&L, the following adjustments and assumptions are made. Tesla books the majority of depreciation and amortization, which is a fixed cost, into cost of goods sold. In order to adjust for the fixed costs, the figures for depreciation and amortization are taken from the cash flow statement, subtracted from COGS and added to selling, general and administrative expenses, which is as well considered to be fixed costs. While R&D expenses could be considered as either fix or variable, in the case of Tesla it gives the impression since also personal expenses are partially booked into research and development expenses, that it should be considered as fixed costs.

As demonstrated by the evolvement of the blue line, there is a significant change in revenues every quarter with one extensive outlier in the fourth quarter of 2012 where revenue increased by 511,4% from the previous quarter. Overall, it can be held that Tesla is, due to the volatility in revenue growth, sensitive to business cyclicality. However, from a purely analytical viewpoint there seems to be no indication that there is more revenue growth in any specific quarter and therefore evidence for seasonality.

The operating leverage was in Tesla's earlier days significantly higher than from the fourth quarter 2012 onwards, having its peak at 86,8% in the second quarter of 2012. Hence, this is a clear sign of a reduction of business risk due to a change in the cost structure towards a higher level of variable costs.

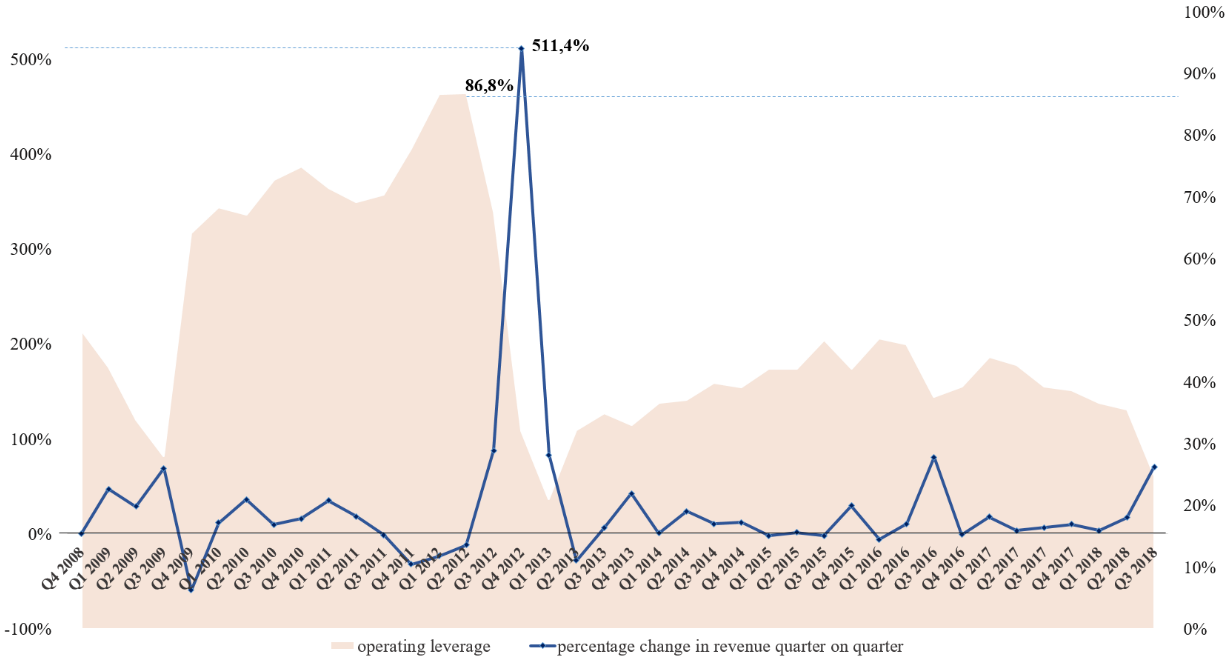

Figure 10: Quarterly percentage change in revenue and operating leverage (S&P Capital IQ, 2019; own data processing, calculations and research)

Another approach to judge the sensitivity of a company to the business cycle is calculating the asset beta of the firm. With an overall asset beta of 0,32 as of January 2019, the global automotive industry can be classified relatively unresponsive for changes in economic conditions. Otherwise, high tech companies associated to the Software or Semiconductor industry face high business risks with industry asset betas in the range of 1,12 to 1,25 (Damodaran, 2019 a).

Regarding the calculation of Tesla's asset beta, two important decisions have to be made: First, how many data points to include and second to choose an appropriate index. Actually, there seems to exist an oversupply of available data. While one could even choose the stock price developments on an hourly base as input parameters, it is most common to use monthly prices over five years to calculate the returns on the market as well as on the stock. However, Groenewold and Fraser (1999) argue that two, three, four, six and seven years of data deliver a superior result to using five years of data, when it comes to forecasting the beta. Since the risk assessment is backward looking and Groenewold and Fraser point out that their results might also be affected by the time series chosen, there is no sound reason apparent not to use a five-year time series as applied by most practitioners.

When it comes to choosing an index to replicate the market portfolio, there are as well several possibilities. Given the restriction that the chosen index or portfolio of stocks is not too concentrated on a specific sector, any broad index such as the e.g. S&P 500, FTSE or Dow Jones Euro STOXX 50 is applicable (Bodie et al, 2017).

The resulting beta of Tesla has to be treated with some caution. When choosing the S&P 500 as index and monthly returns over five years, the levered beta is 0,84. With weekly returns over the last two years the equity beta rises to 1,12 as plotted in *Figure 11*. The R^2, which indicates the significance of the regression line is for both regressions low with 0,036 for the five year data set and 0,0775 for the two year data (Vernimmen et al., 2018). One reason for the higher R^2 for the two-year regression might be that it uses 104 data points instead of only 60 in the five-year data set. Overall, the calculated beta has only little explanatory power with such a low coefficient of determination. The reason for the low R^2 is the greatly uncorrelated returns of Tesla's stock and the returns of the S&P 500, shown by the wide spread of data points.

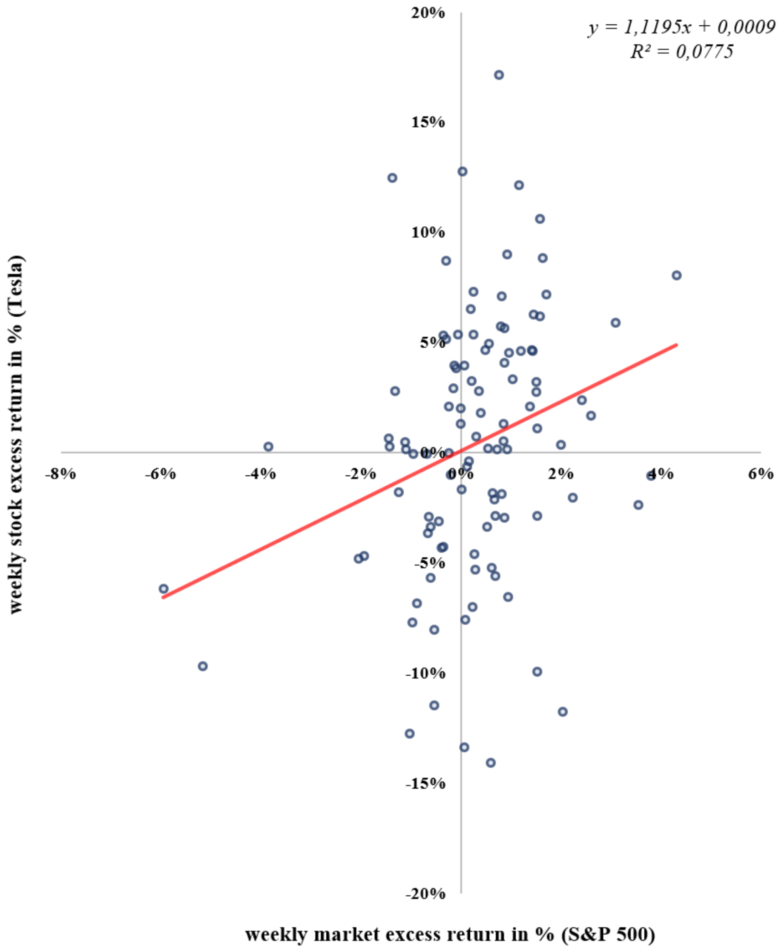

Figure 11: Beta regression based on weekly returns from 30.09.2016 to 28.09.2018 (S&P Market Intelligence, 2019; own data processing, calculations and research[6])

When verifying the result by applying the same time period and frequency with the NASDAQ, an index constituted of tech companies in which Tesla is a component, the resulting R^2 is marginally higher at 0,1108 and the equity beta is 1,098. In addition, external data vendors as well come to different results regarding Tesla's beta. Reuters (2019) and Yahoo Finance (2019) compute a levered beta of 0,99 and 0,34 respectively in August 2019, demonstrating inconsistency when using different time periods,

[6] Data tables and calculations are provided in *Appendix 2*

durations as well as underlying indices for the regression. For the further analysis the two-year weakly regression beta against the S&P 500 with a value of 1,12 is used, potentially reflecting the current situation and risk profile of Tesla more accurately than a data sample with a higher duration. Furthermore, applying the S&P 500 seems more reasonable since that index is broader in terms of industries than the NASDAQ and incorporates car manufacturers such as Ford and General Motors (S&P IQ, 2019).

To un-lever the equity beta, market values for debt and equity as of 30th September 2018 should be applied to replicate the capital structure of Tesla and therefore get the ratio between debt, equity and total firm value (Ross, 2017). To make an effective and standardized comparison between companies possible concerning their unlevered betas, market values from S&P Capital IQ are applied. As of September 30th 2018, the market capitalization of Tesla is 59.490 million USD, the debt outstanding 13.564 million USD and cash & short term investments amount for 2.968 million USD. By applying *Formula 5* and inserting a debt beta of 0,277 for Tesla's debt rating of B- , the resulting asset beta of Tesla is *0,992*. This result suggests that Tesla is slightly less susceptible to changes in overall economic conditions than a weighted average of all companies comprised in the S&P 500 but compared to the industry beta of automotive companies the beta is significantly higher. To gain a comprehensive understanding of Tesla's business risk, Tesla's asset beta is compared to the asset betas of its competitors in the last section of this chapter.

4.1.5 Input costs

The aim of this sub-section is to identify the primary cost drivers for producing electric vehicles, how these costs could evolve in the years coming and therefore affect Tesla's future P&L statements and influence its valuation.

The major input costs are costs of materials, with the battery pack presumed to account for 35% to 50% of total vehicle costs (Kochhan et al., 2014). The batteries for Tesla's current models are lithium-ion cell based and it might be assumed that future generations of battery packs as well rest upon that technology (Tesla, 2018 b). Wagner (2019) states that the global costs per kilowatt-hour for lithium-ion battery packs dropped from 1000 USD in 2010 to 273 USD in 2016 and are expected to amount to approximately 160 USD in 2019. Regarding the future price development of lithium-ion batteries, the opinions coincide. Goldie-Scott (2019) from Bloomberg New Energy Finance predicts that prices for lithium- ion batteries level off to around 60 USD by 2030. Mosquet et al. (2018) suggests a price range of 70 to 90 USD per kilowatt-hour in 2030. A research paper from Deutsche Bank suggests the same price trend for battery packs, although predicting a strong growth in demand for lithium at relatively stable lithium prices (Hocking et al., 2016).

The overall impact of a reduction in input costs, especially a reduction in the cost of the battery pack but also a decrease in costs for electro motors, inverters as well as power electronics, could lower the total price of electric vehicles to that extent, that it is feasible for EVs to compete with cars with combustion engines (Bullard, 2019). Therefore, input costs itself pose a reduction to the overall business risk for Tesla, assisting the company in its transition to attract the mass market of customers.

4.1.6 Technology Durability

Another key question to assess is the longevity of the technology of electric vehicles. One could pose the question if EVs with battery packs are really the future or are those just mid-term solutions until e.g. hydrogen-operated vehicles take over? It definitely matters since Tesla currently undertakes significant investments into battery technology and electric mobility, seemingly believing that electric vehicles become the dominant design in the end. That poses a threat to Tesla if it needed to radically adapt its business model to new technologies and therefore the company might be exposed to substantial switching and sunk costs.

While Holland et al. (2015) find that current electric vehicles produce higher emissions than cars with combustion engines, the problem lies within the energy generation that is inefficient. Contrary, Hall and Lutsey (2018) figured out that in countries with low carbon electricity such as France or Norway, electric vehicles cause less than a third of emissions of normal cars with combustion engines. Although, the production of electric vehicles causes higher emissions than that of ordinary cars, that drawback is offset having the EV one and a half to two years in operation using renewable energy sources.

A strong argument against electric vehicles seems to be the battery pack that at some point in time has to be exchanged or disposed. However, research from Chen et al. (2019) suggest that there seems to be no reason to worry regarding environmental pollution of abandoned battery packs once recycling is effectively implemented. In a trial, it was possible to fully recycle battery packs from different manufacturers and the procedure appears to be scalable for industrial application. Another aspect to consider is the evolution of the battery technology, potentially leading to battery packs with higher energy efficiency and longetivity (Hall & Lutsey, 2018).

While there is wide consensus that vehicles with electric motors as power trains will dominate the market in the very long run, it remains unclear if these vehicles are powered with battery packs or hydrogen fuel cells. Currently, the production of hydrogen costs three to five times as much as that of petrol and is therefore too expensive for mass adoption. Moreover, the storage of hydrogen is considered problematic as if stored in liquid state it has to be cooled down to -253°C which is quite energy intensive. If hydrogen is stored compressed, the downside is that a huge storage tank is needed which is impractical (Blagojevic & Mitic, 2018). Manoharan et al. (2019) predict that hydrogen-based energy generation will become a topic in the future, but only when production is cheaper and the technology is more advanced, estimating the start of mass production for 2030 onwards.

An important topic that will become a key issue is autonomous driving. The SAE Institute brought up a criteria catalogue with features that vehicles need to fulfill to be classified into six levels of autonomous mobility, with Level 3 and higher providing full-autonomous driving (SAE, 2018). While Tesla claims that its self-driving function meets the requirements of Level 3, it is attributed to be somewhere in

between Level 2 and 3 (Walch, 2019). Gao et al. (2016) predicts two scenarios: One with high disruption that is driven by high-tech companies in which fully autonomous driving will be possible 2025 onwards. Under the low-disruption scenario, full-autonomous driving might be delayed because of technical or regulatory barriers and might be in place only after the year 2030.
Since Tesla is one of the pioneers and technology leaders in autonomous driving it seems as if there is no substantial risk inherent regarding its technological positioning. In addition, the focus on electric mobility and battery pack technology appears to be conclusive and Tesla apparently seems to have the capabilities to address new technological trends quickly and therefore retain its positioning even if technological circumstances might change.

4.1.7 Legal aspects

The legal environment can make or break the diffusion of new technologies and developments. There are two actions that governments and countries can take to promote a transition into sustainable mobility and thereby pave the way for electric vehicle manufacturers: First, governmental incentives can foster prospective purchasers to buy electric vehicles and second, a phase out of new registrations of internal combustion engine cars might be able to ban diesel and petrol powered cars in the end.
The United States, currently Tesla's by far largest sales market for electric vehicles, offers tax credits from 2.000 to 7.500 USD per newly bought electric vehicle, depending on the battery capacity (Energy, 2019 b). In China, Tesla's second largest sales market, the subsidy depends on the range of the battery of the EV and can be up to 7.900 USD. Other countries such as e.g. Japan, Norway, the Netherlands, etc. have similar incentive schemes.
What definitely might play into the hands of electric vehicle manufacturers is the fact that many governments ultimately plan to ban cars with combustion engines. Although only very few countries have fixed bans in their legislation until now, many propose to do so. Norway wants to ban all internal combustion engines by 2025, the Netherlands prohibit all new diesel or petrol powered cars by 2030. The United States are undecided when to forbid internal combustion engine-powered cars but California proposes to ban those 2030 onwards. China as well intends to ban cars with combustion engines, but it is not clear when that might become in effect (Buss, 2018).
Another legal factor that could significantly influence market shares of various car manufacturers and tech companies is a strict regulation or a ban on autonomous driving. The major criterion here is the riskiness of self-driving vehicles considering if self-driving is safer than with human activity.
In the US there was already a legislation passed on autonomous driving but the purpose of it is more to inform users of autopilots regarding the risks inherent (Congress, 2017). So far, there is no law in place that prohibits the use of self-driving functions, probably because drivers are still totally responsible and liable for any damages caused by the autopilot system.

While any limit on self-driving in the form of laws would intimidate future growth prospects regarding self-driving vehicles or at least postpone those, other legal aspects such as banning combustion engine-powered vehicles definitely would work in the favour of Tesla, shifting market shares towards EV producers. Therefore, overall legal aspects do not contribute strongly to business risk.

4.1.8 Country risk

The consideration of country risk is the first risk factor in this subcategory for business risk that is not implied in the beta factor and therefore needs to be modelled separately. Since different countries have different political and legal systems, economic structures as well as life cycles, their inherent risk profiles may vary as well. So the question is to what extent Tesla is exposed to country risk if at all. Although Tesla is incorporated in the United States and the US is generally considered as one of the most stable countries in the world and serves as a benchmark with zero country risk, Tesla as of valuation date generates 10,2% of its revenues in China. Therefore, a deeper analysis shall be conducted.

The most suitable approach in the case of Tesla to account for country risk might be to apply an operations-weighted country risk premium (CRP). For that, total revenues are split up per country of emergence and each fraction is multiplied with each country's individual CRP. While there are numerous approaches to come up with a country risk premium, one of the most efficient is to take the difference of the Credit Default Swap (CDS) Spreads[7] of a risky country and a country with no country risk prevailing (Damodaran, 2017).

In *Figure 12* the country risk premium for China is depicted. Calculations are based on average CDS prices derived from 10-year senior debt over a time period of three years until 30. September 2018.

[7] A Credit Default Swap is a derivative contract that provides the buyer with insurance against the risk of default of the underlying asset. See also *Hull and White (2000).*

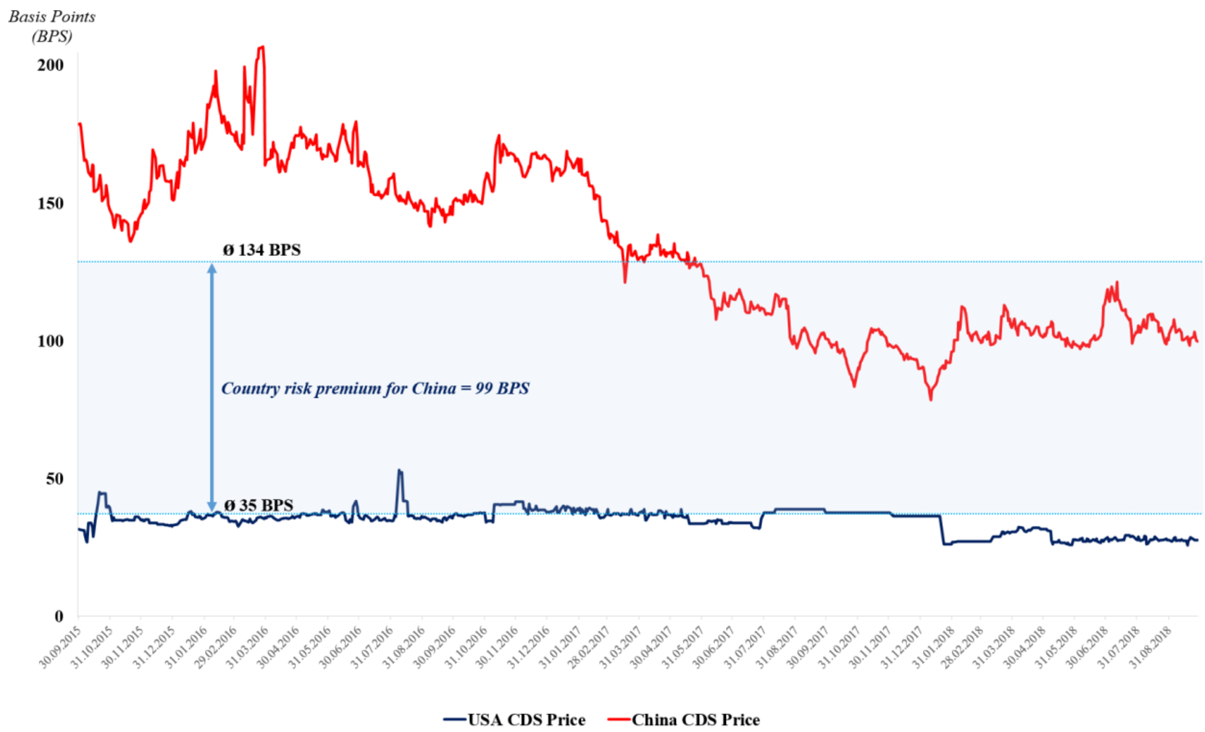

Figure 12: Country risk premium for China
(S&P Market Intelligence, 2019; own data processing and calculations)

The resulting country risk premium of 0,99% for China is very close to that provided by Damodaran. Professor Damodaran provides country risk premiums for almost any country on his private website where he comes up with a 0,98% CRP for China as of January 2019. For the Netherlands and Norway, Tesla's next largest sales markets, the country risk premiums are taken from Prof. Damodaran's website (Damodaran, 2019 b).

As shown in *Table 7*, the appropriate country risk premium for Tesla is almost negligible with 0,10%.

Country	Percentage of total sales	Country risk premium
USA	65,0%	0,00%
China	10,2%	0,99%
Netherlands	4,4%	0,00%
Norway	4,3%	0,00%
all others	16,2%	not applicable
weighted CRP		**0,10%**

Table 7: Operations weighted country risk premium of Tesla
(S&P Capital IQ, 2019 & Damodaran, 2019 b; own calculations)

4.1.9 Comparison and conclusion

This final section on business risk compares Tesla's asset beta to that of its main competitors to give a quantitative assessment regarding its riskiness relative to other companies that face similar business conditions. An overall conclusion afterwards merges the qualitative perceptions of business risk.
The S&P 500 is applied for all beta calculations of Tesla's competitors to ensure the highest level of comparability among the results. Further, the time period chosen is two years with weekly data as applied for Tesla's beta regression. *Figure 13* compares Tesla's asset beta of 0,99 to that of eleven of its competitors. Whereas other car manufacturers such as BMW and Volkswagen have quite moderate asset betas of 0,39 and 0,42, Tesla is definitely exposed to higher business risk, being subjected to the same risk level as leading tech companies such as Apple and Microsoft. That fact further proves that Tesla's operations and business model is significantly different from conventional car manufacturers and has further implications for the valuation i.e. when it comes to choosing comparable companies for the peer group.

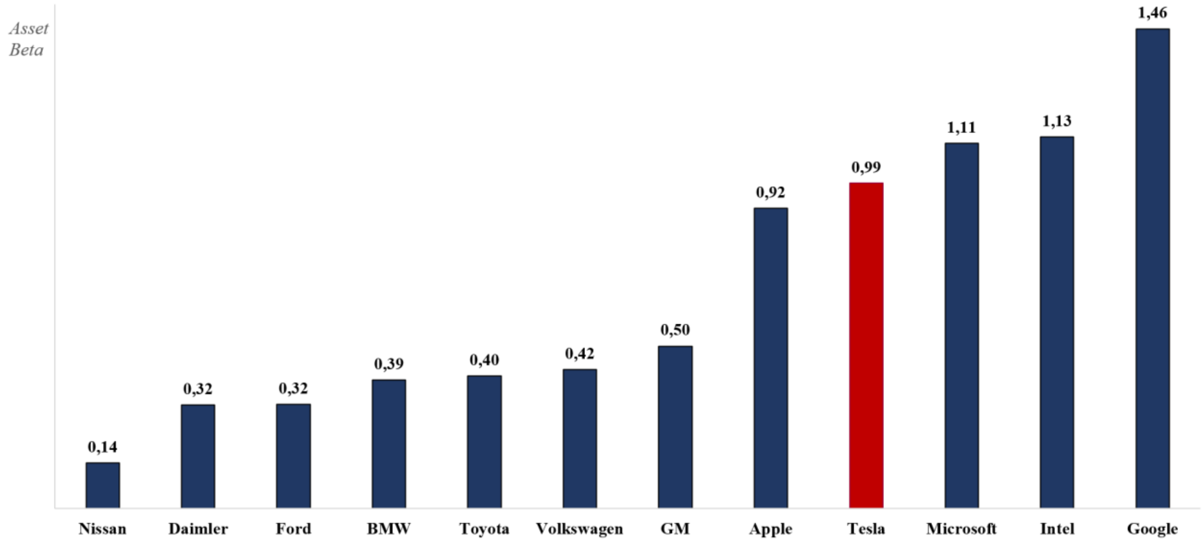

Figure 13: Comparison of asset betas of Tesla and competitors
(S&P Market Intelligence and Yahoo Finance, 2019; own calculations and research[8])

[8] Data tables and calculations are provided in *Appendix 3*

Even though Tesla might face significantly increased competition in the electric vehicle segment in the near future, forecasts of EV market shares draw a very optimistic picture that is backed by a solid overall economic development as well as legal frameworks that favor clean power and therefore electric cars. Moreover, from a technological standpoint, Tesla is not only currently on the forefront of innovators, changing a whole industry, but also having set its strategic focus on a seemingly sustainable technology. With expected reductions in input costs Tesla ought to reach mainstream customers and in consequence be able to achieve sustainable profit margins.

Therefore, the overall business risk is considered as *low* to *moderate*.

4.2 Financial Risk

The section on financial risk follows the same structure as that for business risk. The individual components of Tesla's financial risk are discussed and evaluated and at the end of the chapter a risk comparison to Tesla's competitors is conducted.

4.2.1 Capital structure

A major topic to discuss in any risk assessment and valuation is the company's capital structure. What puts an additional challenge to that endeavor is the fact that there is a *capital-employed* perspective focusing on *market values* as well as a *solvency and liquidity* related view concerning *book values* in the assessment of capital structures. The first approach uses market values for un- and re-levering betas or for the calculation of the weighted average cost of capital (WACC) for going concern valuations. Using book values is appropriate to assess the solvency and liquidity of a company, to calculate ratios such as e.g. Debt-to-asset or Debt-to-Equity and esteem the equity value in a gone-concern scenario (Vernimmen et al., 2018 and Higgins, 2016). What might be judged as controversy is that for calculating the financial beta[9] and therefore financial risk, market values for debt and equity are applied, but for assessing risk components within financial risk such as default risk using e.g. liquidity measures, book values are utilized. Damodaran (2015) addresses that issue by suggesting to compute the beta factor with book values for debt and equity, resulting in an *accounting beta*. Nevertheless, there is a huge trade-off between getting potentially more conservative leverage ratios against having accounting measures that are reported only quarterly and are possibly window dressed [10].

Tough, it can be the case that the difference in book values from market values is just minor. Higgins (2016), argues that this is typically the issue regarding nominal and market value of debt. To test if that also holds for Tesla's equity book and equity market value, *Figure 14* compares the evolvement of both

[9] See *Formula 6*

[10] *Window dressing* is the manipulation of accounting statements within the boundaries of the legal framework. See *Patnaik et al., 2014*

measures over time since Tesla's initial public offering (IPO). The strong divergence of the market value of equity from the book value of equity in the time series suggests, given an approximately identical nominal and market value for debt, that the debt-to-equity ratio and therefore financial leverage, provides a understated picture of financial risk, since financial leverage is substantially lower using marked values of equity. Therefore, all further analysis in this chapter are based on *book values* for debt and equity.

An important adjustment that needs to be taken into account for is minority or non-controlling interest[11]. Since the acquisition of SolarCity in the fourth quarter of 2016, Tesla reports minority interest on its balance sheets until the valuation date. Although Tesla does not possess control of that stake, noncontrolling interest has to be counted towards equity (Koller et. al., 2015). Therefore, for all further analysis, the total book value of equity comprises the book value of equity plus minority interest.

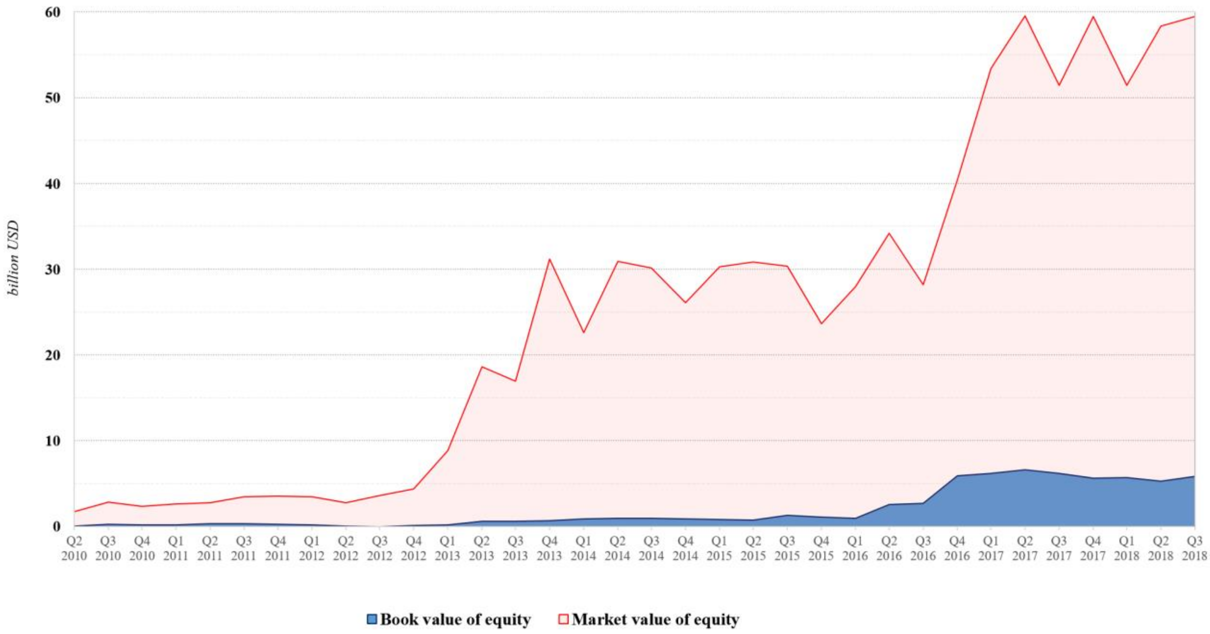

Figure 14: Development of book and market value of Tesla's equity

(S&P Capital IQ, 2019; own data processing and research)

[11] Minority interest is the stake of a third party in one of a company's consolidated subsidiaries. See *Koller et.al., 2015*

The most important key figure that expresses the direct relation between the components of the capital structure is the leverage ratio as expressed by *Formula 6* [12]:

$$Leverage\ Ratio = \frac{Total\ Debt}{Book\ Value\ of\ Equity} \tag{6}$$

Figure 15 shows the development of the capital structure over the last eight years. The representation is corrected for the third quarter of 2012, where Tesla reported negative equity. It is evident that there are two huge leaps where the level of total debt more than doubled. This is due to the issuance of 800 million USD of 0,25% convertible senior notes and 1,20 billion USD of 1,25% convertible senior notes in March 2014 (Tesla, 2014). The second huge increase in debt and equity in the fourth quarter of 2016 is due to the acquisition and consolidation of SolarCity Corporation (S&P IQ, 2019).
Tesla has an average leverage ratio of the factor 2,1 x over the eight years in consideration with declining volatility in the later years. That average leverage ratio results in an average debt- to- total capital ratio of 62%.

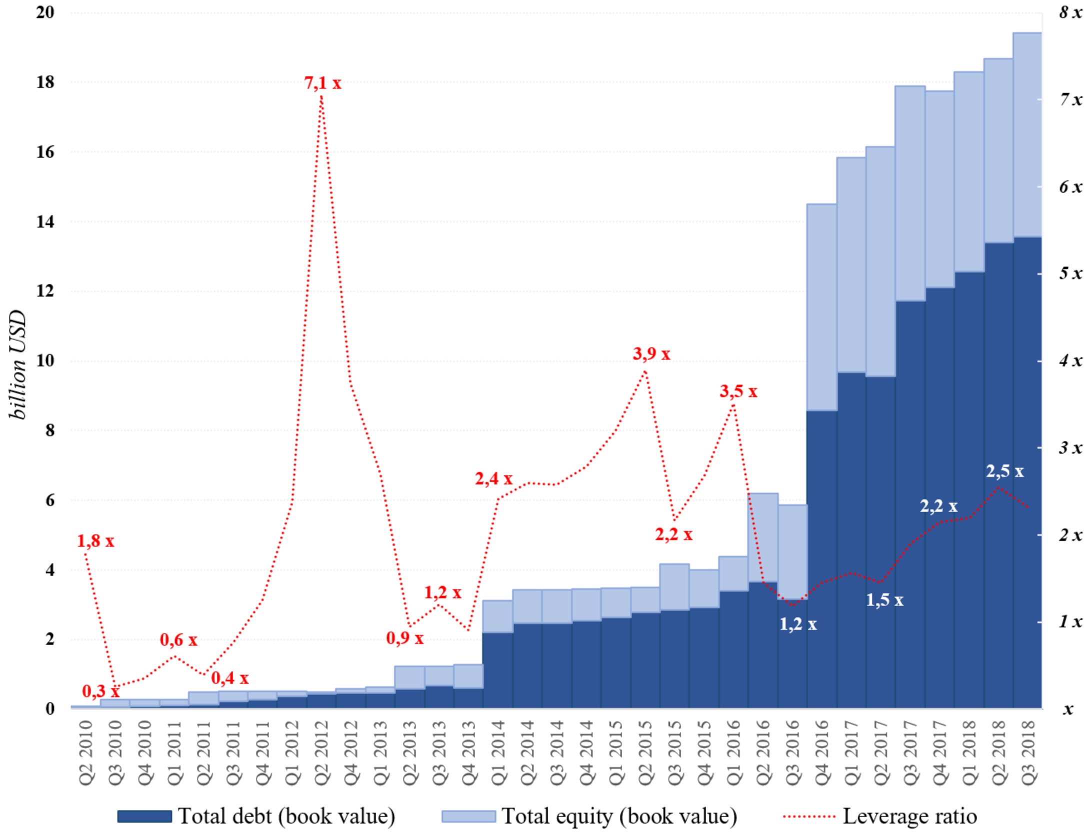

Figure 15: Total Debt, equity and leverage ratio over time

(S&P Capital IQ, 2019; own calculations)

[12] Adapted from Berk and DeMarzo (2017)

An important question to address is if Tesla has a target debt-to-total capital ratio that the company tries to reach or sustain in the long run. In *Figure 16* the analysis focuses on spotting a trend towards maintaining a stable debt-to-equity ratio. While on the left side of the diagram the relation of debt to equity fluctuated strongly over time with a minimum of 21% of leverage to a maximum of 88%, the average leverage was substantially lower than in later years as shown on the right side of the diagram. From the first quarter of 2014 onwards until the valuation date, Tesla maintained a relatively constant average debt-to-total capital ratio of 68%, with a reduced level of volatility in the capital structure, ranging from 54% to 80%.
Rocca et al. (2009) shows that the highest levels of debt on average typically occur in the years five to six since company establishment and from there on gradually decrease. The development of Tesla's capital structure has its debt-peek according to the available data in the second quarter of 2012, which is the ninth year since the company's foundation. Given the relatively constant development of leverage since the first quarter of 2014 and the renewed upward tendency from the fourth quarter of 2016 onwards, there is no significant trend in the time series recognizable that the level of leverage might decrease in the near future, indicating a potential target debt- to- equity ratio in book values of about 70%.

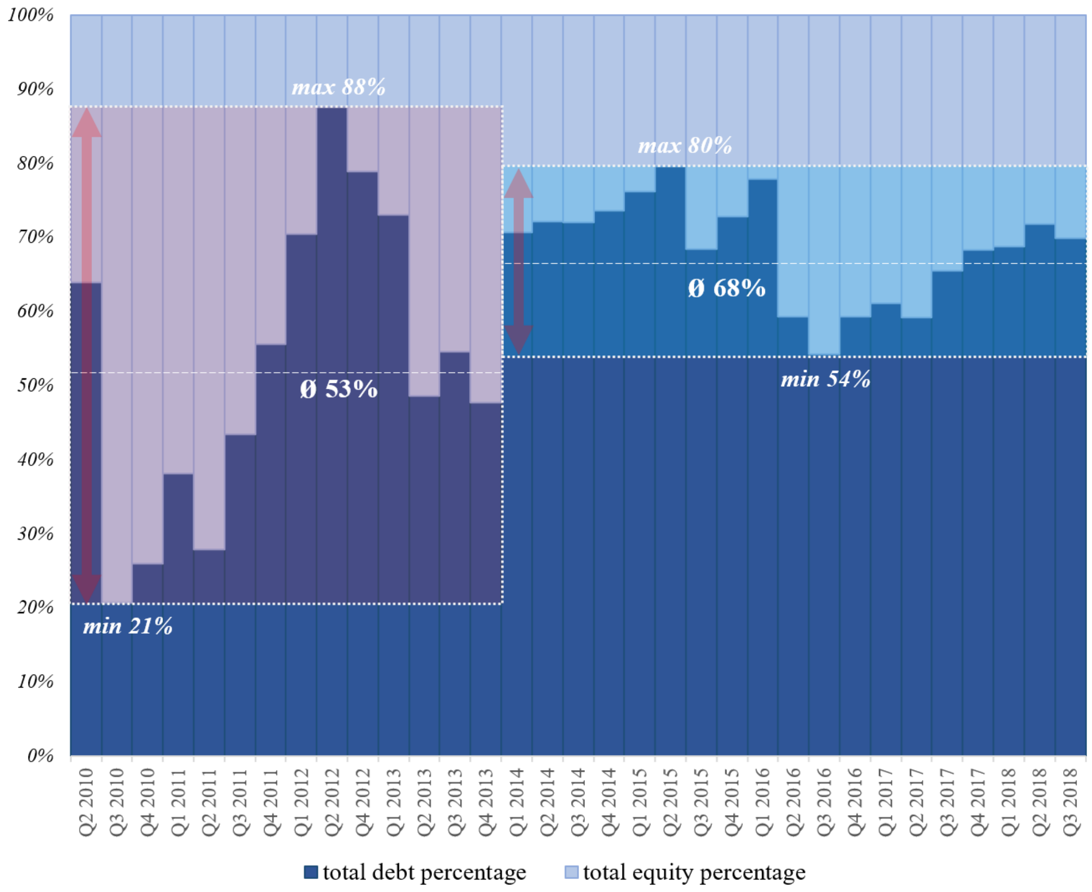

Figure 16: Change in debt and equity proportions over time
(S&P Capital IQ, 2019; own calculations)

Breaking down Tesla's debt portion of its capital structure, the company has the following types of securities outstanding in million USD as of 30th September 2018:

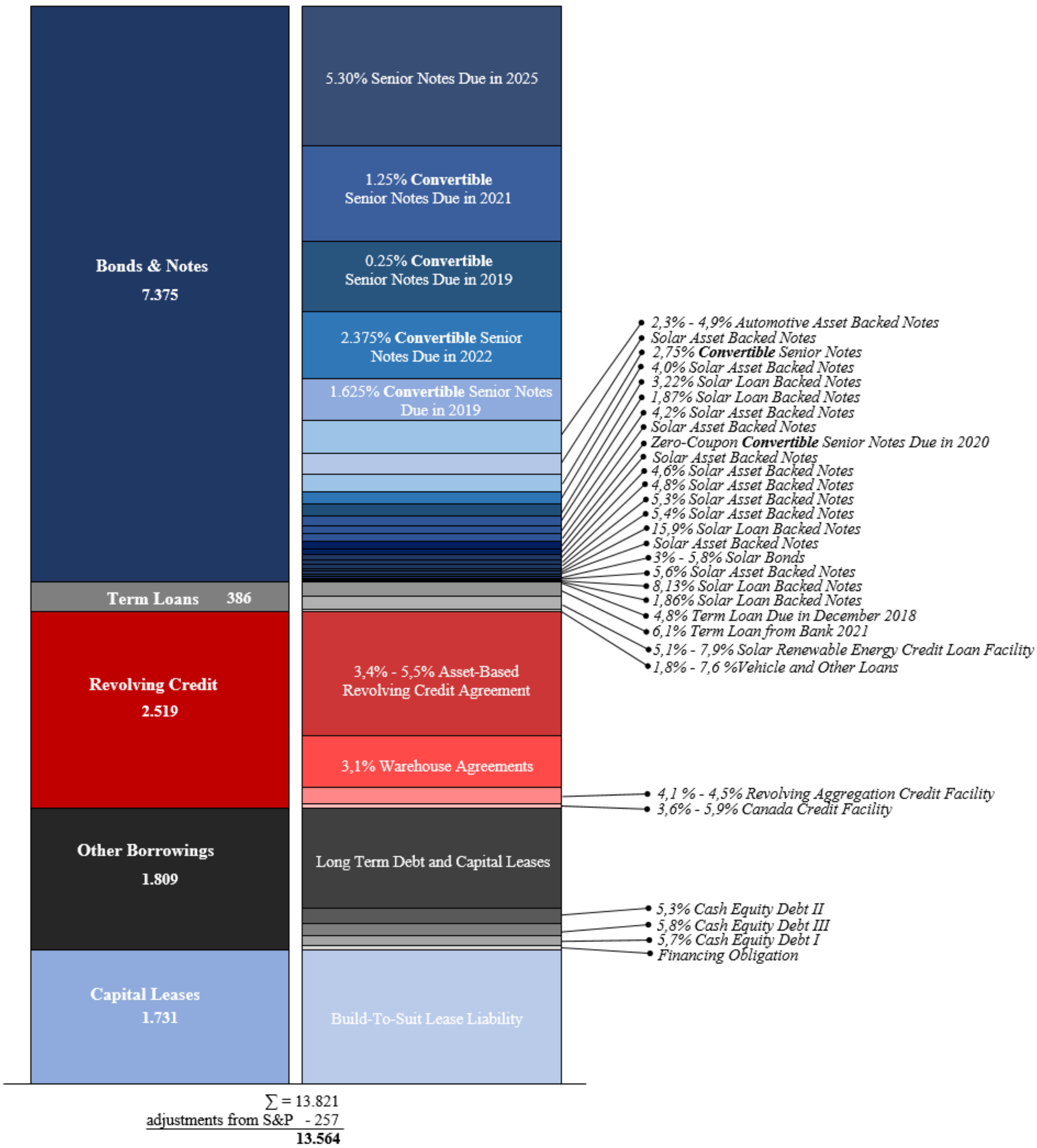

Figure 17: Decomposition of Tesla's debt structure
(S&P Capital IQ, 2019; own data processing)

The debt portion of Tesla's capital structure can be evaluated as complex, not only because of the quantity of its various securities with different rates and maturities outstanding, but also because six bonds have conversion options.

The fraction of the principal due of convertible bonds on total securities is 27,9% and is therefore not negligible since taking the convertible bonds as pure debt versus splitting those up into debt and equity components definitely has an impact on the weighted average cost of capital. Since Tesla reports under US GAAP, the convertible bonds are treated as if it was exclusively debt (Damodaran, 2012). An important issue to discuss is if it is truly necessary to separate the convertible bonds into debt and equity to come up with a valuation. Actually, it is not since there are valuation approaches such as the Adjusted Present Value (APV) model that are unaffected by the choice of the capital structure. Nevertheless, the downside of not considering splitting the convertibles up is being very limited to back test the APV result with other valuation methods. Therefore, a thorough assessment of the convertible securities seems inevitable to get a robust valuation result.

When assessing the structuring of the bonds, three of the securities not only have conversion options but also detachable warrants[13]. What further complicates the circumstances is that Tesla has entered into bond hedge transactions and capped call options to counterbalance any dilutive effects from potential conversions, but does not report any market values or a mapping of these securities to the bonds in question. The only indication of a valuation base is an outdated mapping of the stock price to total expected dilution ratios, adding the valuations of the conversion options, the warrants and the counteracting hedges as of ultimo 2016. The fact that a convertible bond that matured already in June 2018 is as well included in the schedule makes the data actually useless (Tesla, 2016d). For all those reasons, the effect of the hedging positions on the convertible bonds cannot be further investigated.

The options of the convertible bond can be classified as European-style call options, since these are only executable at maturity and the bondholders have the right to exercise them. Koller et. al. (2012) suggest to in a first step to assess if the conversion options of the convertible bonds are in-the-money[14] or out-of-the-money and recommend that if those are *deep* in-the money to treat the convertibles as equity since conversion is then probable. Likewise, if the options are *deep* out-of-the money they should be treated as debt. While the literature suggests many ways how to hedge and rebalance portfolios with options over time as well as how to calculate the intrinsic value of options, a rather simplified view seems to be that stating an option is "in-the-money" when the exercise date is years ahead and the status quo of that option might change many times (Hull, 2018). Otherwise, trying to forecast years ahead and predict the probability if an option is in-the-money seems not to add more value to the analyses. Therefore, all convertible bonds that are roughly *at-the-money* and have a material principal amount are

[13] A detachable warrant is a combination of a warrant and another security such as a bond. The difference between a warrant and a call option is that the warrant requires the company to issue new shares if exercised while with the call option the number of shares outstanding remains the same. *See Bodie et. al., 2017*

[14] A call option is in the money if its exercise price (K) is below the underlying's current market value (S) since the party who exercises the call can buy the underlying security at a lower price (strike price) than the current market price. Therefore, the option should be exercised if $S > K$. *See Hull, 2018*

further investigated. What is more, for the underlying stock price, a mid-price of the two trading days[15] of USD 287,74 per share is applied to counteract the volatility of the stock and most accurately represent the stock price on the valuation date, 30th September, 2018.

Table 8 shows the status quo of the conversion options and warrants as of 30th September 2018. The only bond that might be considered to be at-the-money, with K ~ S is a Zero Coupon Bond maturing in December 2020. But with a principal amount of only 90,4 million USD, separating it into debt and equity has no significant effect on the overall capital structure and is therefore needless. All other convertible bonds and warrants are either out-of-the money or deep out-of-the money and since US GAAP treats convertibles by default fully as debt, there is no need for any further action.

Maturity date	Coupon rate	Principal amount in million USD	stock price (S) in USD	Approximate conversion price (K) in USD	Status quo of option	Warrant strike price (K) in USD	Status quo of warrant	Assessment	Action
2018-11-01	2,750%	231,7		560,6	deep-out of the money	not applicable	not applicable	count fully as debt	no need for action
2019-03-01	0,250%	901,5		359,87	out-of-the money	512,66	deep out-of-the money	count fully as debt	no need for action
2019-11-01	1,625%	535,7	***287,74***	759,36	deep-out of the money	not applicable	not applicable	count fully as debt	no need for action
2020-12-01	0,000%	90,4		300	at-the-money	not applicable	not applicable	not material	no need for action
2021-03-01	1,250%	1.228,7		359,87	out-of-the money	560,64	deep out-of-the money	count fully as debt	no need for action
2022-03-15	2,375%	863,8		327,5	out-of-the money	560,64	deep out-of-the money	count fully as debt	no need for action

Table 8: Tesla's convertible bonds as of valuation date
(S&P Capital IQ, 2019; own research)

After having assessed Tesla's debt in detail, it is obligatory to have a thorough look on the equity components. Although there are no exact values reported in Tesla's quarterly filings, the company has 10,88 million stock options and 4,69 million restricted stock units[16] outstanding as of 31st December 2017 (Tesla, 2018 a).

The restricted stock units have an average time to transfer of half a year. Damodaran (2005) argues that there are factors influencing the valuation of restricted stocks. First, the *period of trading restriction*, meaning that the longer the stock is not in the possession of the employee and therefore sellable, the higher the illiquidity premium that should be applied on the market price of the stock. Second, the greater the *volatility* of the stock, the higher the illiquidity premium should be since employees cannot sell or effectively hedge the stocks since they are not in possession yet. Damodaran suggests a discount in the range of 20% to 30% on the market price of the stock, depending on its volatility and the length of the restriction period.

The time to transfer can be considered as quite short, given it is on average half a year but the annualized volatility of Tesla's stock return of 49,72% can be evaluated as quite high with the S&P 500 having an average annual volatility of only 20,1% based on the years 1926 until 2014 (Berk and DeMazo, 2017).

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[15] 28th September 2018 with USD 264,77 per share and 1st October 2018 with USD 310,70 per share

[16] Restricted stocks are stock remunerations for employees that are passed to the employees after a specified restriction period. See *BofA (2015)*

The calculation of the volatility of Tesla's stock return is based on a data sample of daily prices from 29th September 2017 until 28th September 2018, comprising 252 trading days. For the computations *Formulas (7) to (10)*[17] are applied. X_t are daily stock returns and t are trading days.

$$Sample\ mean = \overline{X} = \frac{\sum X_t}{t} \quad (7)$$

$$Variance = \sigma^2 = \frac{\left(X_t - \overline{X}\right)^2}{t-1} \quad (8)$$

$$Daily\ standard\ deviation = \sigma = \sqrt{\sigma^2} \quad (9)$$

$$Annualized\ standard\ deviation = \sigma * \sqrt{trading\ days\ per\ year} \quad (10)$$

For the number of trading days, all 252 days of the data set are chosen. All data and calculations are provided in *Appendix 4.*

Given the low time to transfer but high volatility of the stock returns, the mean score of Damodaran's recommendation is chosen for the discount, therefore applying 25%. Once again, the mid-price of 287,74 UDS per share is applied, capturing the timing of the valuation date best. Since no figure for restricted shares is reported as of 30th September 2018, the number of the ultimo of 2017 needs to be applied, yielding 4.689.310 restricted shares (Tesla, 2018 a). By applying *Formula 11*, the final equity valuation has to be reduced by ***337,32 million USD.***

$$Equity\ valuation\ adjustment = discount\ factor * stock\ price * restricted\ shares \quad (11)$$

Tesla's stock options[18] are generally exercisable by the employees after a vesting period of up to four years with a weighted average contractual life of 5,3 years. The weighted average exercise price is 105,56 USD and as of 31st December 2017, 10.881.025 options are vested (Tesla, 2018 a). Just as for the restricted stock units, the available data for the stock options is for the following calculations carried forward until the valuation date.

Since the exercise price strongly deviates from the stock price, the options are deep in-the-money. Although Tesla reports fair values for the options in its annual financial statements, these estimates should not be used if the deviation of exercise and stock price is too large. Therefore, an option pricing model needs to be applied (Koller et.al., 2015). This fact leads to some estimation problems inherent in employee stock options, making them more complex to value than normal call options.

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[17] Taken from *Babbel and Fabozzi, 1999*

[18] Employee stock options are long call options that can be exercised by the employees after a specific time period, called vesting period. *See Hull, 2018*

Besides of not being provided with an exact vesting period in the annual statement, Tesla states an average remaining contractual life of 5,3 years to exercise the options, for a maximum period of 10 years from the grant date (Tesla, 2018 a). This implies that the employees on average hold the option for 4,7 years, if no one exercises any option early. Another problem arises with employees that leave the company within the vesting period and therefore are unable to exercise their options. Hull, 2018 suggests to use a binomial option pricing model, if a probability for early exercises and early job terminations can be evaluated. Otherwise, the Black-Scholes-Merton model might be used.

Since there are no more assumptions given in Tesla's annual statements, the chosen approach is a modified form of the Black-Scholes-Merton model. *Formulas (12) to (14)*[19] show the basic version of the Black-Scholes-Merton model to value European call options. S_0 is the current stock price, K the strike price, r the risk free rate and T is the average time to exercise or expiry. Since Tesla pays no dividends, there has to be no dividend yield rate included in *Formula (14).*

$$d_1 = \frac{\ln\left(\frac{S_0}{K}\right) + \left(r + \frac{\sigma^2}{2}\right) * T}{\sigma * \sqrt{T}} \tag{12}$$

$$d_2 = d_1 - \sigma * \sqrt{T} \tag{13}$$

$$c = S_0 * N(d_1) - K * e^{-r*T} * N(d_2) \tag{14}$$

Damodaran (2005) suggests to adjust the current stock price S_0, since the exercise of the options increases the number of shares outstanding at a lower price level and therefore dilutes the shares. *Formula 15* incorporates the effect of dilution, with n_s being the number of shares outstanding and n_o the number of options.

$$S_{0\,adjusted} = S_0 * \left(\frac{n_s}{n_s + n_o}\right) \tag{15}$$

Furthermore, Damodaran proposes to lower the average time to exercise to incorporate the effect of early exercise. Moreover, if a probability of vesting is ascertainable, the calculated option value can be weighted with that probability. Abbudi and Beninga (2012) back that approach by finding that employee stock options have a discount of about 50% compared to normal call options calculated with the Black-Scholes-Merton model.

For S_0 the mid-price of 287,74 USD is applied and then adjusted for dilution. The average time to exercise is reduced by a conservative 20% to account for early exercise. The probability of vesting is not considered since it cannot be assessed precisely. The annualized standard deviation is calculated

[19] Taken from *Hull, 2018*. See also *Black and Scholes, 1973*

from a time series of four years of daily prices and amounts to 48,51%, not being far off from the 49,72% that is obtained by using one year of daily prices. For the risk free rate a US treasury bond with a three year maturity is chosen, replicating the time to exercise of the option best. The US treasury rate as of 1st October 2018 is 2,90% (S&P Capital IQ, 2019). All calculations and interim results are provided in *Appendix 5*. The resulting option price is 185,23 USD per option leading to a total equity valuation adjustment of **2.015,53 million USD** that have to be deducted from the equity valuation result.

4.2.2 Distress risk

An essential issue to discuss in the context of financial risk is the scenario in which Tesla would have to file for bankruptcy. In general, a corporate default occurs if a firm is insolvent, being not able to meet the financial obligations to its creditors. That happens if the market value of the assets is less than the book value of debt and therefore assets no longer equal liabilities on the balance sheet (Gilson, 2010). In the US, bankruptcy is covered in the United States Bankruptcy Code[20]. For valuation purposes there are two important chapters of that bankruptcy code to consider, Chapter 7 and Chapter 11.

Under Chapter 7, the company is *liquidated* where a trustee appointed by the Office of the United States Trustee collects and sells the company's assets. That procedure is more likely to be applied by smaller companies, having a shortage of financial resources needed for a complex and long reorganization process.

In the case of Chapter 11 bankruptcy, the company is *restructured*. The firm must not even be insolvent to file for Chapter 11 protection, but doing so triggers an "automatic stay" which freezes a creditor's legal claim against the company's assets. Therefore, Chapter 11 serves the company to restructure its debt with the intention to retain a going-concern value. There is as well the possibility that a Chapter 11 bankruptcy case can be altered into a Chapter 7 case. From the frequency of filings, Chapter 7 cases strictly dominate Chapter 11 cases in the time period from 1981 until 2009 (Ratner et al., 2009 & Gilson, 2010).

The predominant question to assess for any further investigation is if Tesla actually is exposed to significant default risk. Given the latest events in Tesla's corporate history prior to the valuation date as well as the fact that Q3 of 2018 is only the third quarter in the company's history when the company reports a positive net income, there is decent reason to give the issue a critical review (S&P Capital IQ, 2019). The rating agency Moody's downgraded their corporate rating opinion on Tesla from Caa1 to B3 in March 2018, reasoning that Tesla fails to reach its production targets as well as having a very poor liquidity position, potentially needing to raise about 2 billion US dollars in the near term to remain solvent (Moody's, 2018 b). The subsequent attempt of Tesla's CEO, Elon Musk, to take Tesla private at 420 USD per share backfired significantly, as it turned out that the announcement was illegal. The

[20] See also *www.usbankruptcycode.org*

incident not only attracted the attention of the SEC, but also most likely impaired investor confidence, making it potentially harder to receive future financing (Badkar and Bond, 2018).
Besides having the corporate rating as indication for distress risk, there are distress prediction models such as the Altman Z-Score or the Ohlson o-score, the first one being more regarded. The Altman Z-Score is a linear multifactor model that was introduced in 1968 and is unaltered applied by professionals to date. While there are modifications for private firms, the original model was developed for public manufacturing companies and can therefore be innocuously be applied to predict Tesla's distress risk (Altman et al., 2014). *Formula 16*[21] sets out the calculation of the Z-Score.

$$Z = 0{,}012 * X_1 + 0{,}014 * X_2 + 0{,}033 * X_3 + 0{,}006 * X_4 + 0{,}999 * X_5 \tag{16}$$

with

$$X_1 = \frac{Working\ capital}{Total\ assets}$$

$$X_2 = \frac{Retained\ earnings}{Total\ assets}$$

$$X_3 = \frac{Earnings\ before\ interest\ and\ taxes}{Total\ assets}$$

$$X_4 = \frac{Market\ value\ of\ equity}{Book\ value\ of\ total\ debt}$$

$$X_5 = \frac{Sales}{Total\ assets}$$

The resulting Z-score is then according to Altman et al. (2013) classified into one of the following three categories: A Z - Score above 2,99 states that the company is healthy and situated in the "safe zone".
If the Z – Score is between 2,99 and 1,81, it indicates that the company is in a "grey zone", facing moderate uncertainty regarding its future solvency. Having a Z – Score below 1,81 signals a high risk of bankruptcy, with the company being in the "distress zone". *Figure 18* shows the development of Tesla's Altman Z – Score over time, once with the original weights and unaltered P&L as well as balance sheet items and then again with modifications from Standard and Poor's. The grey zones in the diagram represent periods with greater uncertainty while the red areas indicate times with a high risk of bankruptcy. It is recognizable that the distress periods are prolonged in later stages of the time series

[21] Original weights still apply. Taken from *Altman, 1968*

and the dotted linear trend line suggests even lower Z-Scores forthcoming. As of 30th September 2018, the calculated Z – Score is 1,47 while the from Standard and Poor's derived Z - Score is 2,16. Given the overall development and status quo as of the valuation date, Tesla's financial viability can be evaluated as critical.

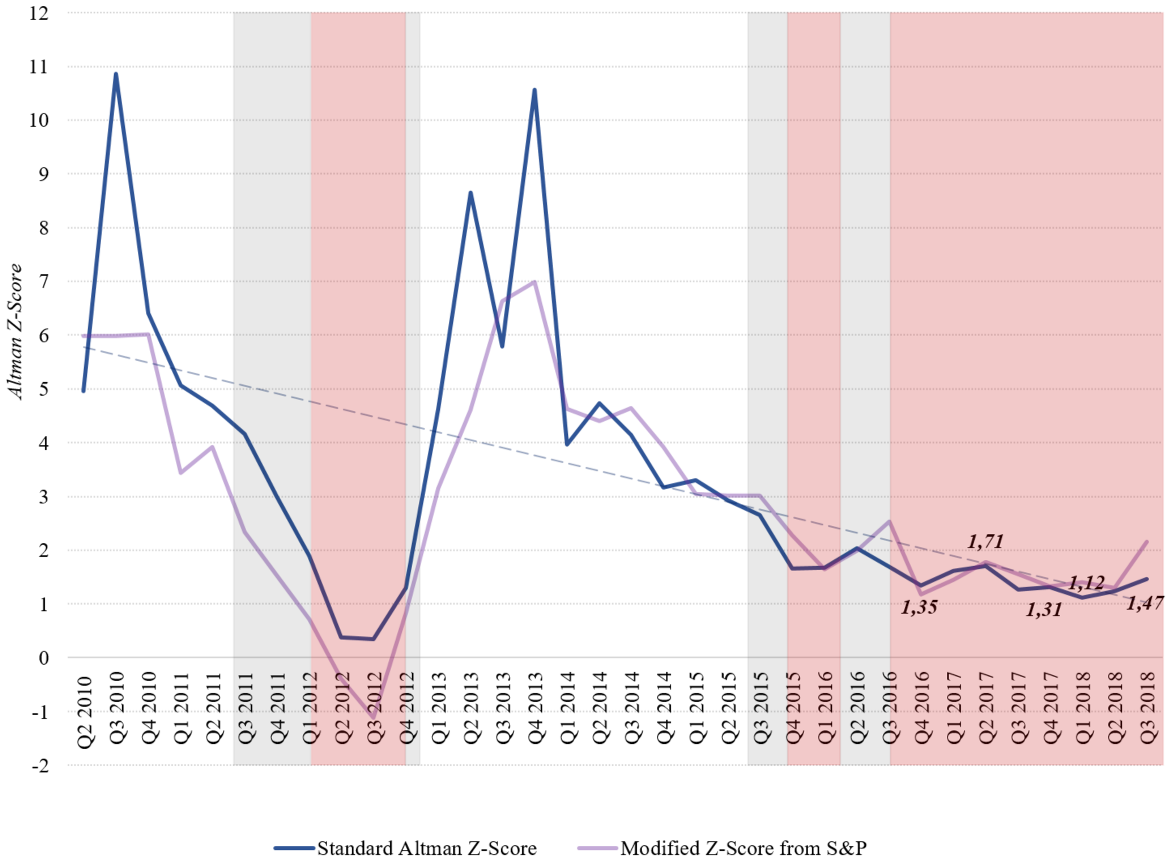

Figure 18: Altman Z-Scores over time
(S&P Capital IQ, 2019; own calculations)

After having clarified that Tesla faces non-negligible bankruptcy risk, the final step in the assessment of distress risk is to measure the amount of risk in terms of default probability.

A first attempt to take Tesla's default risk into account was already undertaken in *Chapter 4.1.4 – Sensitivity to the business cycle*, by incorporating a debt beta of 0,277 for the company's B- rated debt. That result could be used to calculate the cost of debt applying the Capital Asset Pricing Model (CAPM). However, the intuition of *Table 6* in *Chapter 4* was a different one, providing a transition that can be easily applied to various companies, thereby accepting that this approach is potentially not the most precise one.

The most sophisticated method to come up with a default probability is by incorporating the likelihood of bankruptcy into the yield-to-maturity calculation of the bonds outstanding, inserting actual bond prices as of the valuation date. The drawback of that approach is that recovery rates of the bonds have to be estimated and in the case of Tesla, to be absolutely precise, all 25 bonds would need to be evaluated, with two bonds having coupons that are based on floating rates (Titman and Martin, 2016 & S&P IQ, 2019). Furthermore, Almeida and Philippon (2005) argue that the resulting yield, derived from the yield-to-maturity calculation can contain other risk components such as a liquidity premium, making it hard to accurately fraction out the default risk.

Therefore, the most straightforward approach to come up with a default probability might be to derive it via the rating provided by a rating agency and a default table. Moody's last rating activity regarding Tesla was the overall downgrade in March 2018 to B3. *Table 9* shows the cumulative and annual default probabilities for the rating category B3 for ten years based on global default rates from the period 1998-2017.

Year	Cumulative probability of default	Annual probablility of default
1	3,84%	3,84%
2	9,31%	5,47%
3	15,25%	5,94%
4	20,17%	4,92%
5	24,60%	4,43%
6	28,57%	3,97%
7	31,72%	3,15%
8	34,37%	2,65%
9	36,85%	2,48%
10	38,80%	1,95%

Table 9: Default probabilities for Moody's rating category B3 (Moody's, 2018 a; own table)

4.2.3 Foreign exchange risk

Due to Tesla's global sales markets where it collects revenues and entails costs in foreign currency, the company is exposed to exchange rate risk. The major currencies that entail risks are the Euro, Chinese yuan, Norwegian krone, Japanese yen and the Canadian dollar. Tesla calculated that a shock in exchange rates of 10% in all currencies would in the worst-case have an adverse effect of 154 million USD on the comprehensive income as of September 30, 2018 (Tesla, 2018 b). Therefore, exchange rate risk hardly exists.

4.2.4 Interest rate risk

The last risk to consider is interest rate risk. Tesla pays for seven of its securities with a total principal due of 2.337 million USD (16,9% of total principal due) interest based on floating rates. To hedge against changes in interest rates Tesla partly applies derivative contracts. Tesla calculated that a 10% change in interest rate would have an adverse effect of an increase of interest expense of 5,9 million USD as of September 30, 2018 (S&P Capital IQ; Tesla 2018 b). Therefore, the impact of interest rate risk is negligible.

4.2.5 Comparison and conclusion

To obtain a comparison as conclusive as for business risk, book values for debt and equity are applied to calculate the beta factors. These "accounting betas" shall more accurately carve out the risks incorporated in the capital structures of Tesla's competitors as laid out in *Chapter 4.2.1 – Capital structure*. Furthermore, minority interests are counted towards equity for all competitors as well as for Tesla (Koller, et al., 2015). *Figure 19* compares the total financial risk of Tesla with that of its competitors. Thereby, *Formula 6* is applied on the re-calculated betas.

$$\beta_F = \beta_E - \beta_A \qquad (6)$$

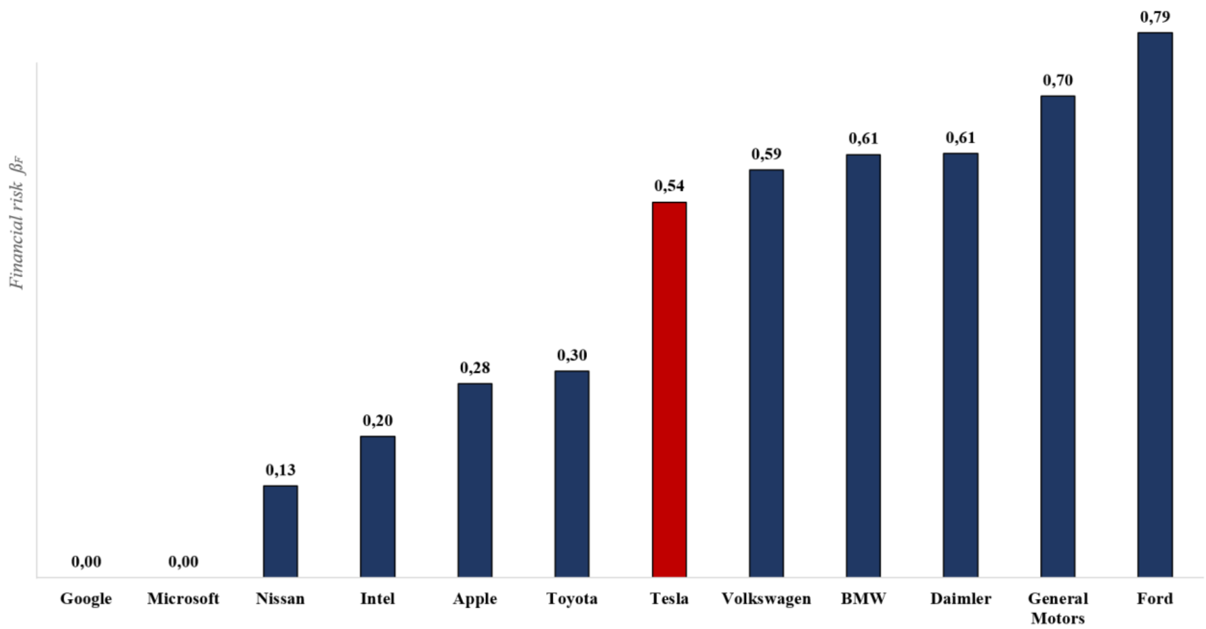

Figure 19: Tesla's financial risk compared to the competition

(S&P Capital IQ, 2019; own calculations)

As depicted in the graph, Tesla's overall financial risk is medium compared to its competitors. With technology companies such as Google or Microsoft far to the left facing literally no financial risk at all, Tesla seemingly builds the transition as a hybrid of car- and high-tech company, outpacing traditional car manufacturers such as Daimler and Ford with higher financial risk.

However, how robust are the accounting based beta factors? S&P's capital IQ provides a probability of default model based on market signals that predicts over the same period as for the beta derivation (two years of trading days until 30th September 2018), that out of the five competitors that have a higher total financial risk, General Motors, Ford and Volkswagen have a higher probability of default (Baldassari and Chen, 2016 & S&P Capital IQ, 2019).

Given that results, Tesla's level of financial risk does not seem too severe at all. Nevertheless, the complex capital structure with its various option-like features as well as the distress probability need to be taken into account in the company valuation.

5 Valuation

In this main chapter, after a short introduction on the nature of valuation and a discussion on applicable valuation models, all compiled findings of the previous chapters are merged with additional aspects to consider e.g. peer group, costs of capital and finally molded into a valuation model, providing clarification on the true value of Tesla. Thereby, starting with a base case valuation resting upon consensus estimates, a point estimate for Tesla's enterprise and equity value is derived. Building on this valuation, the scope is extended to incorporate a sensitivity analysis as well as a scenario analysis to obtain a plausible range of values for Tesla's value per share. Finally, the intrinsic valuation results are verified by a relative valuation.

5.1 The concept of valuation

What is "value"? There is a significant difference between the *value* and *price* of a company. While capital market oriented companies, which shares trade on a stock exchange, have inherently a market-based valuation, expressed as stock price, the true value of the company itself can strongly deviate from its current share price (Graham and Dodd, 1934; Fernandez, 2019 a).

The term "valuation" in general is rather vague. Damodaran (2012, 2) describes it as follows: *"Valuation is neither the science that some of its proponents make it out to be nor the objective search for true value that idealists would like it to become. The models that we use in valuation may be quantitative, but the inputs leave plenty of room for subjective judgments. Thus, the final value that we obtain from these models is colored by the bias that we bring into the process."*

It is necessary to set out that there is not "one right value" when performing a valuation. Indeed, any valuation is influenced by the uncertainty regarding future outcomes and the quality of data as input parameters. Ultimately, it is about assessing how a company and the industry it operates in will probably evolve in the future, taking into consideration e.g. competitors, technologies, risk factors, the overall growth of the economy, et cetera and thereof derive estimates regarding discount rates and cash flows.

The accuracy of any valuation decreases the more immature the business is, not only because it is harder to forecast future outcomes but also commonly because of the shorter financial history and ceteris paribus poorer quality of financial information about the company. For these reasons, it is often common to not state an exact value but rather give a range of potential values.

What is more, it is important to note that values of companies are not static but change with any information update. Therefore, performing a valuation of the same company at two points in time will highly likely result in different outcomes.

Finally, every valuation is model-based. The decisive point to think about is as how complex to make a model since there exists a trade-off between making the model more realistic by including more input parameters and in the same time raising the chances for input errors. The other extreme holds true for models with only very few inputs e.g. The Gordon model, which has only three variable. Getting it wrong on only one input ultimately has a severe impact on the overall valuation outcome (Damodaran, 2012; Penman, 2015).

5.2 Valuation methods and models applicable

According to Fernandez (2019 a) there are in general four mayor approaches to value a company.

1.) *Discounted cash flow valuation (DCF)*: For this approach, cash flows have to be forecasted and then discounted to derive a value. Depending on the cash flows and discount rates chosen, the equity value, total enterprise value or only components of the company can be calculated.
2.) *Relative valuation*: This approach is also called *multiples valuation.* Thereby, the enterprise or equity value is calculated as a multiple of an income statement item such as e.g. Sales, EBIT, NOPLAT or a balance sheet item such as e.g. book value of equity. Relevant benchmarks from a peer group are applied to derive the valuation result (Koller et al., 2015).
3.) *Balance sheet-based valuation*: Here the base for the valuation is the company's assets. This method can be used to find a liquidation value, given the company has to file for bankruptcy in a gone-concern scenario. The liquidation value can be considered to be the minimum valuation base. The equity value is attained by selling the company's assets and deducting the liabilities and any expenses related to the liquidation.
4.) *Real Options*: That approach is used to value strategic opportunities, applicable to companies with projects that provide some kind of future flexibility, e.g. potential expansions or acquisitions, new business lines, deferring an investment, outsourcing or renegotiating contracts (Fernandez, 2019 b).

The question is which approaches are most applicable for the valuation of Tesla. One of the easiest to apply valuation models that do not need a great amount of inputs and estimates is the Gordon Growth Model that discounts expected dividends. However, since Tesla does not pay out any cash dividends on its stock and does not intend to do so in the near term the Gordon Growth Model cannot be applied (Gordon, 1959 & Tesla, 2018 a).

An important choice to make in determining which DCF approach to choose is to decide whether to calculate the Adjusted Present Value (APV), the enterprise value with the weighted average costs of capital (WACC) or the equity value with the required return on equity (Equity approach). While in theory, all three approaches can be adapted to result in the same outcome, the practical implementation of the APV approach might be difficult. This is because the APV method provides a valuation by components, valuing the company as if it was fully equity-financed and afterwards factoring in the tax shield as well as the after-tax cost of debt. The APV method has some benefits such as irrelevance of capital structure and therefore change in leverage and circumventing circularity problems as with the traditional WACC approach. However, Damodaran (2012) argues that one of the most severe errors that

happen in practice by applying the APV model is that the expected bankruptcy costs are often times not incorporated into the model. On the other hand, if they are included as an additional factor the question is raised if and what other factors need to be added to arrive at a complete valuation result.
Another practical issue of the APV is the appropriate discount rate applicable for the tax shield conditional on its riskiness, being undecided by professionals (Enzinger and Kofler, 2010).
Aschauer and Purtscher (2011) argue that the choice of the valuation model as well depends on the financing policy of the company. For the APV approach to work properly without circularity problems the company needs to have a constant level of debt in place while the WACC method requires a constant leverage ratio. The equity approach itself cannot be solved without iteration since if the debt level is constant, to derive the required return on equity, the valuation of the equity is needed. On the other hand, if the debt ratio is constant, the Equity approach needs the enterprise value for every year of the forecasting period as well as the terminal value to apply the debt ratio and finally derive the appropriate amount of debt due per period that needs to be subtracted to obtain the cash flows to equity. This as well needs iterations.
As depicted by *Figures 15* and *16* of *Chapter 4.2.1. - Capital structure*, Tesla's level of debt rises significantly over time but the leverage ratio stabilizes form the first quarter of 2014 onwards. Therefore, it is assumed that Tesla has a target capital structure and wants to maintain it. The most suitable valuation model therefore seems to be the WACC method. Furthermore, a reasonable approximation for the liquidation value in a worst-case scenario or a definite lower bound for a value seems to be prudent. Moreover, performing a relative valuation shall give assurance that the valuation outcomes from the DCF are not too far off and that therefore the valuation results are overall consistent.
The real option valuation approach is not applied since there is no clear evidence of any future strategic projects or other indications that require the application of option pricing models.

5.3 Peer group

A basic concept in valuation is to compare the company in consideration with other firms on specified metrics and incorporate their prices as well as other components such as the beta factor.
Therefore, a group of comparable companies (peer group) has to be selected. Although there is no perfect match for any company since every business has unique characteristics, the following framework should be applied in selecting peers (Aschauer and Purtscher, 2011):

1.) *Industry*: Companies within the same industry should face similar business risks, growth aspects and profitability.
2.) *Size*: The peer companies should have a comparable size, measured in market capitalization, sales or balance sheet total.

3.) *Growth expectations*: If available, analyst consensus and growth expectations of the stock price of capital market-oriented companies should be taken into consideration when selecting the peers.
4.) *Financial status*: The capital structure and financial risk should be considered thoroughly for deriving the peer group.

Furthermore, the peer group should contain at least four to six companies to obtain reliable results. If there are more than a dozen companies, it should be considered too narrow down the peer group or provide a valid reason for the necessity of the number of peers. *Table 10* provides the key metrics of Tesla's chosen peer group. The selected peer group consists in total of 15 companies, eight of these are car manufacturers, six are high tech companies and one is a photovoltaic manufacturer.
Given Tesla's exposure to business risk as ascertained in *Figure 13* in *Chapter 4.1.9 – Comparison and conclusion,* Tesla positions well among high tech companies such as Apple and Microsoft. Therefore, all high-tech companies of that chapter are taken as peers and expanded with Nvidia for its graphics processor units applicable to autonomous driving and Panasonic because of the joint venture in battery production. Regarding car manufacturers, Peugeot, BAIC and BYD replace Nissan and Toyota because those companies better capture the financial risk Tesla is exposed to. Moreover, since BAIC and BYD are based in China and mainly cover the Chinese market, both companies replicate Tesla's geographic revenue distribution better than the Japanese car manufacturers. To consider Tesla's energy generation and storage segment as well, First Solar is chosen to represent Tesla's stake in the solar industry.

Industry	Company Name	Country	LTM Diluted EPS Excl. Extra Items	Market Capitalization Latest	LTM Net Debt	Analyst Consesus 1Y Growth Rate (Median)	Market Cap based leverage	Credit Model Score	S&P Credit Health Panel			
									Overall	Operational	Solvency	Liquidity
Automobile	BAIC Motor Corporation Limited (SEHK:1958)	China	0,07	6.407	-2.647	5,86%	-0,41	bbb-	3	2	2	4
	BYD Company Limited (SEHK:1211)	China	0,12	19.484	6.587	4,44%	0,34	bb	3	3	2	3
	Bayerische Motoren Werke Aktiengesellschaft (DB:BMW)	Germany	13,52	55.951	93.125	-3,93%	1,66	bbb	3	2	4	4
	Daimler AG (XTRA:DAI)	Germany	9,39	64.449	133.077	3,97%	2,06	bb+	4	3	4	4
	Ford Motor Company (NYSE:F)	United States	1,58	36.868	129.826	15,00%	3,52	bbb-	3	3	4	2
	General Motors Company (NYSE:GM)	United States	0,76	47.505	83.669	15,35%	1,76	bbb	4	4	3	3
	Peugeot S.A. (ENXTPA:UG)	France	2,91	23.006	-9.482	6,34%	-0,41	a	2	2	2	3
	Volkswagen AG (XTRA:VOW3)	Germany	29,03	83.221	161.343	10,75%	1,94	bbb+	4	4	4	3
High Tech	Alphabet Inc. (NasdaqGS:GOOG.L)	United States	26,65	834.977	-102.430	15,82%	-0,12	aa-	1	1	1	1
	Apple Inc. (NasdaqGS:AAPL)	United States	11,91	1.090.308	48.182	12,50%	0,04	a	2	1	2	2
	Intel Corporation (NasdaqGS:INTC)	United States	3,2	218.054	14.688	7,50%	0,07	a	1	2	1	2
	Microsoft Corporation (NasdaqGS:MSFT)	United States	2,43	877.014	-47.843	12,30%	-0,05	a	1	1	3	1
	NVIDIA Corporation (NasdaqGS:NVDA)	United States	6,86	170.860	-5.942	10,50%	-0,03	a-	1	1	1	1
	Panasonic Corporation (TSE:6752)	Japan	0,93	28.982	591	-6,29%	0,02	a-	3	3	2	4
Solar	First Solar, Inc. (NasdaqGS:FSLR)	United States	-3,25	5.075	-2.258	20,00%	-0,44	bb-	2	4	3	1
	Tesla, Inc. (NasdaqGS:TSLA)	**United States**	**-10,56**	**45.168**	**10.597**	**35,00%**	**0,23**	**bb-**	4	4	3	4
	Mean of peer group		*7,07*	*237.477*	*33.366*	*8,67%*	*0,66*					
	Median of peer group		*2,91*	*55.951*	*6.587*	*10,50%*	*0,04*					

Table 10 Peer group and selected metrics

(S&P Capital IQ, 2019; own table)

5.4 Stock performance and market capitalization

At Tesla's initial public offering on 28th June, 2010, 13,30 million shares of common stock were tendered at an offering price of 17 USD per share. As of September 30th 2018 there are 171.732.775 shares of common stock outstanding with a closing price of 264,77 USD on Friday, September 28th, 2018 and a share price of 310,70 USD on Monday, October 1st 2018. Given that abrupt price spike of 45,93 USD, a mid-price of 287,74 USD is applied to compare the valuation result with. All further calculation regarding the share price on the valuation date are based on this average price.

The market capitalization has increased more than 219 times from the market cap of initially 226,1 million USD at the IPO until the market cap on the valuation date of 49.413,5 million USD (S&P Market Intelligence, 2019). *Figure 20* visualizes the development of Tesla's total stock return since its inception and compares it to the evolvement of the S&P 500. From mid-2013 on, Tesla's stock outperformed the market portfolio, represented by the S&P 500, significantly.

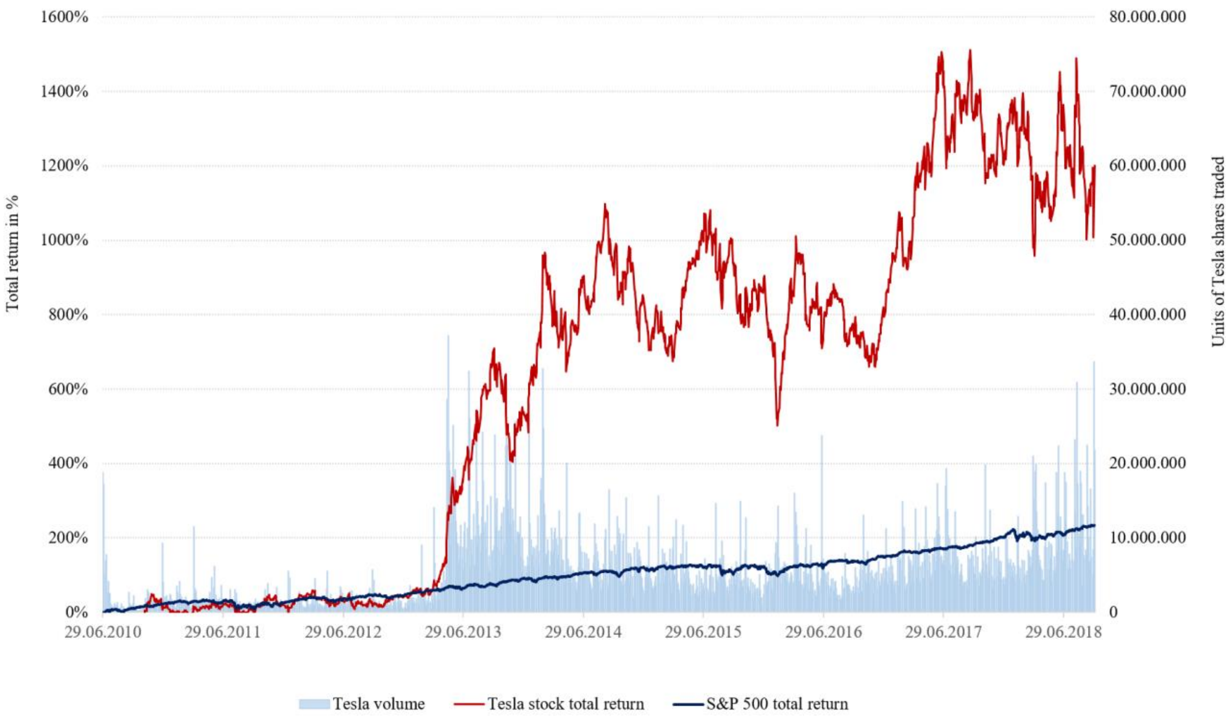

Figure 20: Development of Tesla's total stock return compared to the S&P 500 total return (S&P Capital IQ, 2019; own research)

Figure 21 compares Tesla's market capitalization to that of its peer group as of September 29, 2019. While Tesla's markets capitalization is in the range of established car manufacturers such as Ford and General Motors, leading tech-giants Google, Microsoft and Apple outperform Tesla substantially based on that metric.

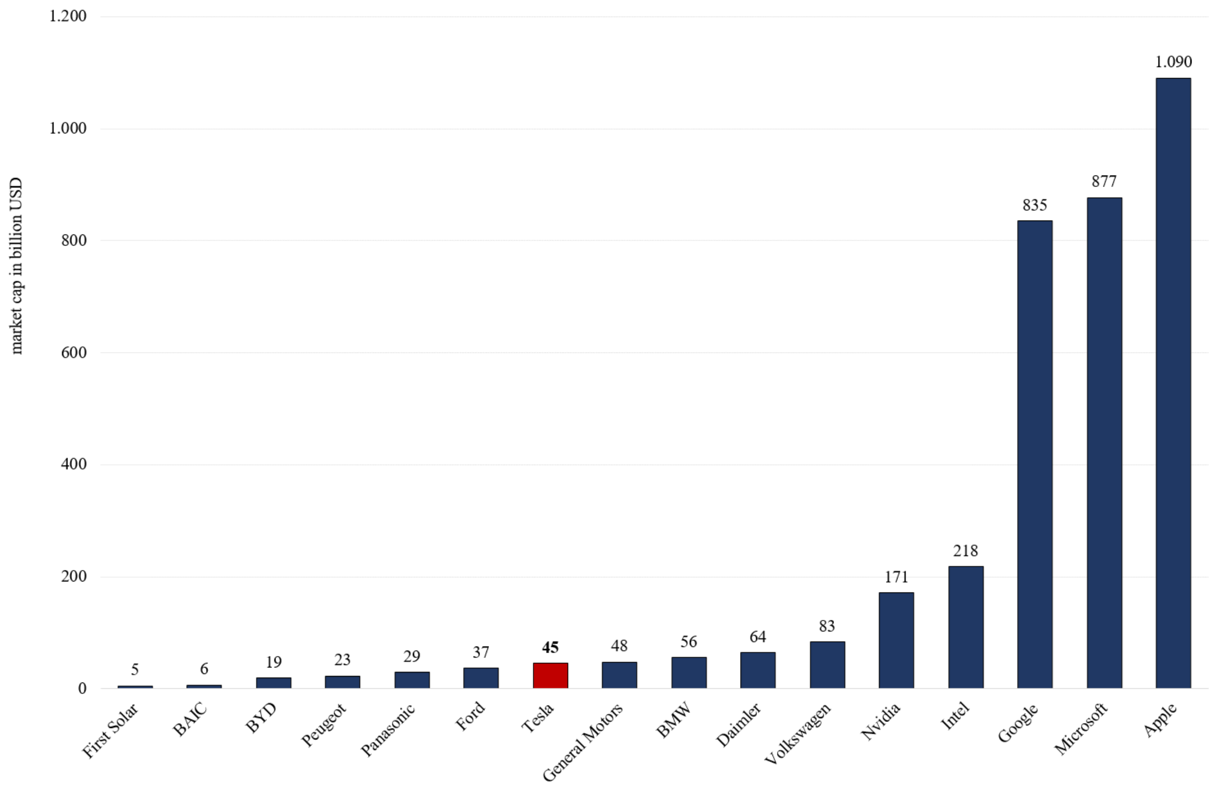

Figure 21: Tesla's market capitalization compared to its peer groups'
(S&P IQ, 2019; own research)

5.5 Adjustments of financial statements

Valuing Tesla as of September 30, 2018 induces some judgements to make. The profit and loss statement of Q3 2018 only represents the accumulated results of the first three quarters of the financial year 2018. Since no literature could be found on how to properly adjust the profit and loss statements, the following two methods are proposed:

1.) Replicating a "full financial year" (: $FY_{replicated}$) by adding the results of the fourth quarter of the previous year to the three quarters of the current year as proposed by *Formula 17:*

$$FY_{replicated} = Q3_t + Q4_{t-1} - Q3_{t-1} \quad (17)$$

2.) Projecting the “full financial year” result by arguing that the last quarter will yield on average the same result as the previous three quarters, shown in *Formula 18:*

$$FY_{replicated} = \frac{Q3}{3} * 4 \tag{18}$$

There are pros and cons to both approaches. While the first method results in financial statements that are of the actual valuation date it could be considered as more precise. The drawback is that to conduct a historical analysis, the financial statements of all prior years need to be manually restated, always incorporating the fourth quarter and the following three quarters to receive a full year of financial data, which is prone to errors. Another argument is that the year-end figures of 2017 are audited and therefore more accurate. But by subtracting out the first three quarters that are unaudited, that effect gets lost since it is unclear if the cut-off within the quarters is drawn correctly i.e. reallocation of revenue across accounting periods (Patnaik and Satpathy, 2014).
Therefore, the second approach seems to be of no less meaning than the first one. Furthermore, most analyst consensus that provides forecasts of Tesla’s key figures is conducted for full financial years, starting with the new calendar year. Hence, the second approach is applied to obtain a base year for the DCF valuation.
Regarding Tesla’s balance sheet, the figures of the third quarter are taken and adjusted for an expected net loss of 1.487 million USD as of 31st December 2018. This effect is actually incorporated as it assumes that total assets grow by 30% in the financial year 2018. Given that Tesla’s total assets grew by 70% annually from 2014 to 2017 with growth slowing down drastically from 2016 to 2017 to only 26,4%, a 30% growth assumption for 2018 is rather cautious, taking into account Tesla’s ambitious growth strategy. For the aligned positions of the balance sheet and income statement for the year 2018, see *Appendix 6*.

5.6 Historical figures analysis

To derive cash flows for the DCF valuation model it is of importance to examine historical data. The key value driver in the DCF approach is revenue growth. Therefore, *Figure 22* visualizes total revenues as well as year-on-year percentage growth of revenues since 2010. The compound annual growth rate (CAGR) yields astonishing 89,0% over the period of eight years. The calculation of the CAGR is based on *Formula 19* [22].

$$CAGR = \left(\frac{First\ revenue}{Last\ revenue}\right)^{\frac{1}{n\ years}} - 1 \tag{19}$$

[22] Adapted from *Berk and DeMarzo (2017)*

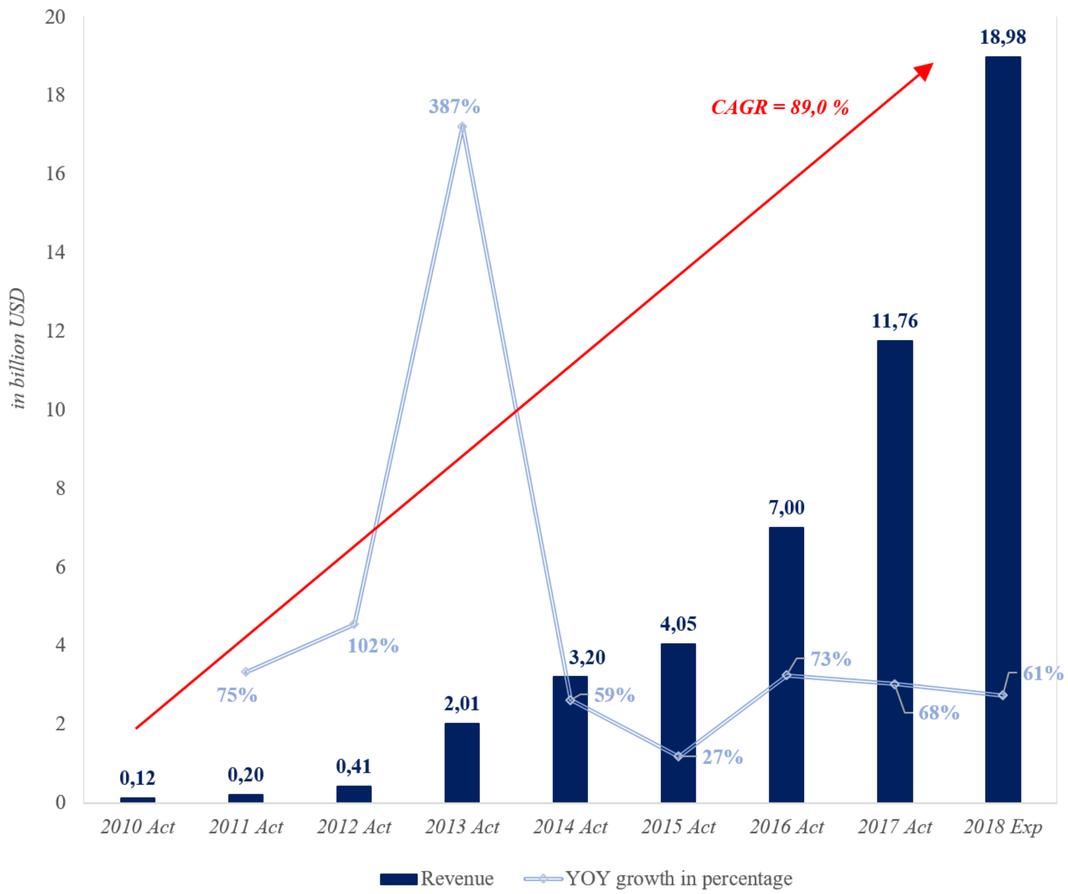

Figure 22: Tesla's absolute revenue, revenue growth and CAGR of revenue (S&P IQ, 2019; own graph and calculations)

Another important item to examine is Tesla's net working capital, since changes in the level of working capital directly influence the derivation of free cash flows and therefore the valuation outcome. The working capital is the cash position that is daily needed to keep the company in operation. While the working capital can be expressed as an absolute value, it can as well be understood as the average total time period between cash outflow and cash inflow of one production series. The average time between the cash payment of inventory and the receiving of cash from the finished products is called the *cash conversion cycle* or cash cycle, expressed with *Formula 20* [23].

$$\text{Cash conversion cycle} = \text{Accounts receivable days} + \text{Inventory days} - \text{Accounts payable days} \tag{20}$$

[23] Taken from *Berk and DeMarzo (2017)*

where

$$Accounts\ payable\ days = \frac{Accounts\ payable}{Average\ daily\ costs\ of\ goods\ sold}$$

$$Accounts\ receivable\ days = \frac{Accounts\ receivable}{Average\ daily\ sales}$$

$$Inventory\ days = \frac{Inventory}{Average\ daily\ costs\ of\ goods\ sold}$$

The *operating cycle* on the other hand measures the average actual time period between buying inventory using financial payables and the point in time when the firm receives cash from selling the finished goods. Therefore, to obtain the operating cycle, accounts payable days are added back to the cash conversion cycle (Berk and DeMarzo, 2017).

Figure 23 shows the trend of the operating cycle and cash cycle over time. It can be observed that for both cycles the cash collection periods are reduced over time and that the gap of the cycles narrows down gradually, caused by a reduction in accounts payables days. The cash conversion cycle of only 11 days in 2017 and 16 expected days in 2018 are quite low, resulting in a small working capital.

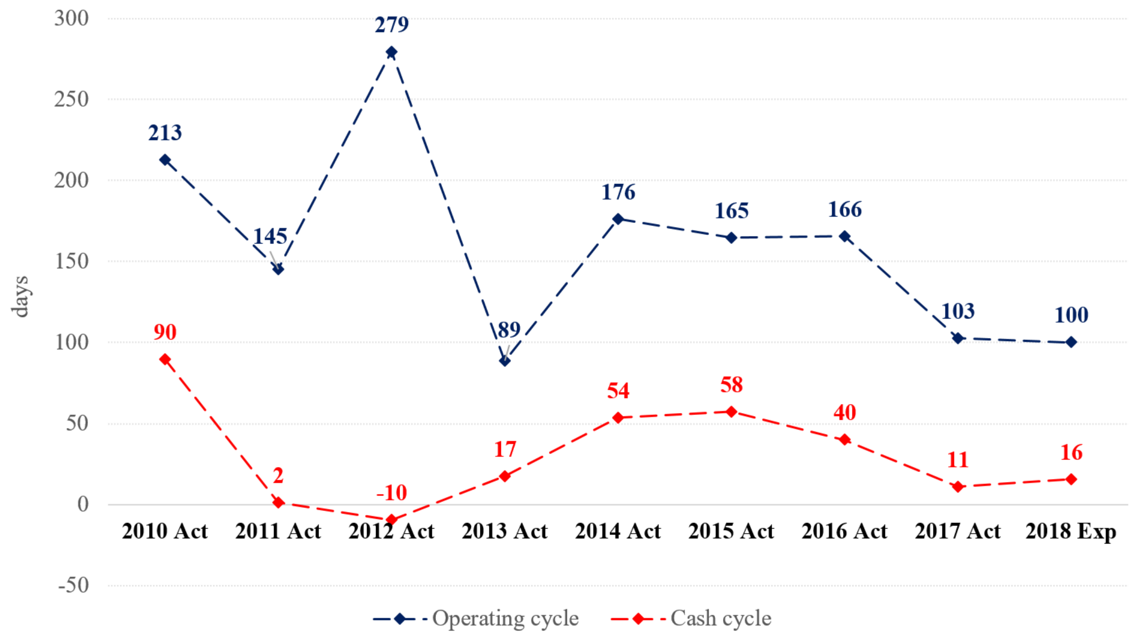

Figure 23: Tesla's operating and cash cycle
(S&P Capital IQ, 2019; own graph and calculations)

Another important ratio to analyze is the degree of wear (DOW), which clarifies the wear of Tesla's fixed assets. *Formula 21* [24]shows the computation of the degree of wear:

$$Degree\ of\ wear = \frac{Accumulated\ depreciation}{Gross\ property,\ \ plant\ \&\ equipment} \tag{21}$$

Tesla has an average degree of wear of 11,7% over the period from 2013 until 2017, whereby the yearly DOW stays relatively constant in a range of 8,6% to 13,2% with a DOW of 11,6% in the year 2017. This shows that Tesla's fixed assets are fairly new and in a good condition.

5.7 Discounted cash flow valuation

This section of the thesis deals with the main valuation model. After deriving the components of the discount factor, all findings and assumptions of the previous chapters are considered when forecasting the ingredients of the free cash flows.

5.7.1 Cost of capital

For the cash flows of the DCF model a discount rate needs to be applied. Since the chosen DCF model calculates the enterprise value, the discount rate needs to take into consideration the minimum rate of return for both shareholders and debtholders, expressed as the weighted average cost of capital or WACC (Vernimmen et al, 2018). *Formula 22* shows the individual components of the WACC [25].

$$WACC = r_E * \frac{E}{D+E} + r_D * \frac{D}{D+E} * (1 - t_c) \tag{22}$$

with

r_E	being the required return to equity
r_D	being the required return to debt
E	being the book or market value of equity
D	being the book or market value debt
t_c	being the nominal or effective tax rate

Each of these five inputs have to be further discussed on how to be plausibly derived.

[24] Adopted from *Bertl et al. (2019)*
[25] Adopted from *Brealey et al. (2011)*

Starting with the *required return to equity*, Damodaran (2012) considers four possible ways to estimate the return to equity: 1.) The capital asset pricing model (CAPM) 2.) The arbitrage pricing model (APT) 3.) Multifactor models 4.) Proxy models.

The advantage and at the same time principal reasoning for the major use of the CAPM by professors and industry professionals is that it is on the one hand the easiest to use model requiring the least amount of inputs and on the other hand, the more complex models in many cases do not provide a more accurate depiction of risk (Aschauer and Purtscher, 2011 and Damodaran, 2012). Therefore, the CAPM is used. *Formula 23* presents an extended form of the CAPM [26].

$$r_E = r_f + ß_E * MRP + CRP \quad (23)$$

with

r_f being the risk-free rate

$ß_E$ being the levered beta

MRP being the market risk premium

CRP being the country risk premium

The *risk-free rate* is the expected return when investing in an asset that bears no risk of default. Given that there actually are no such assets existent, to approximate the risk-free rate the safest asset availabe is selected which is i.e. a bond issued by the government. To obtain the risk-free rate for Tesla the US treasury yield for 30 years as of 28th September 2018 is chosen (Titman and Martin, 2016 & Treasury.gov, 2019). Therefore, the applicable risk-free rate is ***3,19%***. The structure of the yield curve can be obtained in *Figure 24.*

[26] Adopted from Kranebitter and Maier (2017)

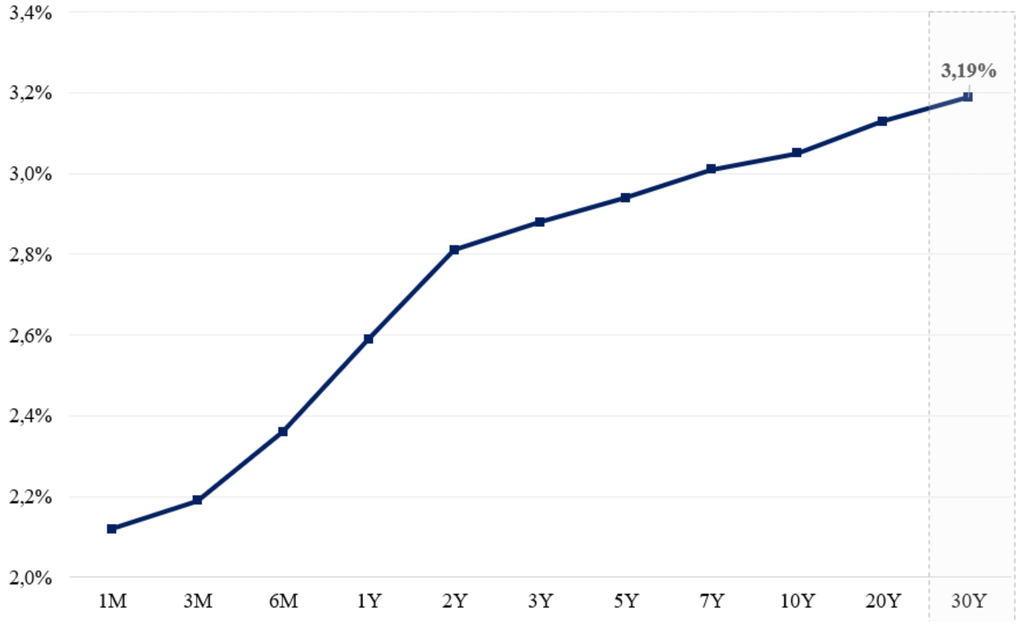

Figure 24: Structure of the US treasury yield curve as of 28th September 2018 (Treasury.gov, 2019; own graph)

The applicable *beta factor* can be derived in various ways. The most straightforward approach is to regress only Tesla's stock returns against a reference index as already conducted in *Chapter 4.1.4. – Sensitivity to the business cycle.* The resulting equity beta is 1,12 based on two years of weekly data or 104 data points. The problem with this approach is that the coefficient of determination (R^2) is only 0,0775 and therefore has only little explanatory power. Furthermore, the resulting beta is based on Tesla's implied capital structure with market values. As discussed in *Chapter 4.2.1.- Capital structure,* it can be observed that the capital structure based on book values levels off to become somewhat stable over time, implying the goal of keeping a target capital structure, but at the same time the book and market value of debt and equity deviate strongly, resulting in a rather unstable capital structure based on market values. For all these reasons, it seems advisable to derive the beta based on the peer group (Aschauer and Purtscher, 2011). Therefore, individual equity betas for each peer are derived and then unlevered to obtain the asset beta, using *Formulas 4* and *5* as discussed in *Chapter 4 – Risk assessment*. From the unlevered betas of the peers the average or median is calculated as well as the average or median of the debt and equity ratio based on market values. Afterwards, the average/median of the unlevered beta is re-levered using the average/median of the debt and equity ratios by applying *Formula 24* [27]. Damodaran (2015) argues that the debt/equity ratio of the company to value as well can be applied to re-lever the unlevered beta factors.

$$\beta_E = \beta_A + \frac{D}{E} * (\beta_A - \beta_D) \tag{24}$$

[27] Adopted from *Fernanedez (2008)*

The resulting levered beta ($ß_E$) is by practitioners called the “raw beta”. Since there is a tendency that betas converge to 1 in the long run, the raw betas might be adjusted to incorporate this effect. *Formula 25* shows the adjustment of the equity beta (Schobinger and Filleux, 2018).

$$\beta_{adjusted} = \frac{2}{3} * \beta_{raw} + \frac{1}{3} * 1 \quad (25)$$

Table 11 shows the the derivation of the adjusted equity beta calculation. Peers with a negative Net debt are capped at zero for calculation purposes. Furthermore, given the strong variations in the debt to equity ratios of the peers with a median D/E ratio of 5,0% and an average D/E ratio of 77,9%, Tesla’s D/E ratio based on market values as of September 30, 2018 is applied to re-lever the asset betas of the peers. The resulting equity beta used as input factor in the CAPM is the median of the adjusted betas with a value of ***1,07***.

Industry	Peer company	Equity beta	Debt beta	Asset beta	Market capitalization in local currency (million)	Net debt in local currency (million)	D/E ratio	Re-levered equity beta (raw)	Adjusted beta
Automobile	BAIC Motor Corporation Limited (SEHK:1958)	0,917	0,074	0,917	50.577	0	0,0%	1,07	1,04
	BYD Company Limited (SEHK:1211)	1,285	0,074	0,953	142.645	53.766	37,7%	1,11	1,07
	Bayerische Motoren Werke Aktiengesellschaft (DB:BMW)	1,04	0,017	0,392	48.485	84.017	173,3%	0,46	0,64
	Daimler AG (XTRA:DAI)	0,966	0,018	0,316	54.936	120.062	218,5%	0,37	0,58
	Ford Motor Company (NYSE:F)	1,110	0,100	0,318	35.761	129.826	363,0%	0,36	0,57
	General Motors Company (NYSE:GM)	1,137	0,100	0,496	51.643	83.669	162,0%	0,57	0,71
	Peugeot S.A. (ENXTPA:UG)	0,996	0,200	0,996	20.971	0	0,0%	1,14	1,09
	Volkswagen AG (XTRA:VOW3)	1,13	0,07	0,424	72.781	145.564	200,0%	0,49	0,66
High Tech	Alphabet Inc. (NasdaqGS:GOOG.L)	1,463	0,012	1,463	749.418	0	0,0%	1,72	1,48
	Apple Inc. (NasdaqGS:AAPL)	0,961	0,012	0,916	956.625	48.182	5,0%	1,08	1,05
	Intel Corporation (NasdaqGS:INTC)	1,212	0,017	1,133	208.529	14.688	7,0%	1,33	1,22
	Microsoft Corporation (NasdaqGS:MSFT)	1,114	0,010	1,114	785.431	0	0,0%	1,31	1,21
	NVIDIA Corporation (NasdaqGS:NVDA)	1,695	0,074	1,695	156.266	0	0,0%	1,98	1,66
	Panasonic Corporation (TSE:6752)	1,220	0,049	1,220	2.647.243	62.961	2,4%	1,43	1,29
Solar	First Solar, Inc. (NasdaqGS:FSLR)	1,220	0,074	1,220	4.127	0	0,0%	1,42	1,28
Average							77,9%	1,06	1,04
Median							5,0%	1,11	***1,07***

Assumed target capital structure (million USD) based on Tesla market values	
Market cap	59.490,00
Total debt	13.564,20
Cash and short term inv.	2.967,50
Net debt	10.596,70
D/E ratio	***17,81%***

Table 11: Derivation of the adjusted equity beta

(S&P IQ, 2019; own calculations and table)

The *market risk premium* or equity risk premium is a markup that investors demand for investing in the average equity security, individualized by the beta as scaling factor. There are several variants on how to derive the market risk premium:

1.) *Survey premiums* can be determined by asking investors regarding their reimbursement for investing in risky assets.
2.) *Historical premiums* can be derived by calculating past stock returns over a long time period and subtracting the risk-free rate for the same time period.
3.) *Implied equity premiums* can be calculated based on the investors' expected cash flows for an asset, growth assumptions as well as the current stock price. With i.e. the dividend growth model one can solve for the implied required rate of return of equity and ultimately derive the market risk premium.

The approach of calculating implied equity premiums is forward looking as it incorporates expected returns on equity and is therefore methodically sounder than using historical premiums as also any valuation is as well forward looking (Damodaran, 2018). But in the case of Tesla as Tesla pays no dividends or other cash contributions to its shareholders, it is not possible to calculate an implied premium for Tesla. Damodaran (2018) calculated an historical market risk premium of 5,08% for 2018 for the USA based on S&P 500 weekly returns over a two year period. KPMG recommends to use an equity risk premium of 5,50% for the third quarter of 2018 based on historical premium estimates. The same study of KPMG derives an implied market risk premium based on the S&P 500 of around 8% (Groenendijk et al., 2018). Since Damodaran as well as KPMG conclude a market risk premium in the range of 5,1% to 5,5%, the applied market risk premium for the model is ***5,20 %***.
The applicable country risk premium was already calculated in *Chapter 4.1.8-Country risk* and amounts to ***0,10%***. Having all inputs derived that are necessary for the CAPM, the required return of equity amounts to ***8,85%***.

For the second part of the WACC, the *cost of debt* needs to be derived. If the debt is of investment grade (Rating BBB or above) the required return for the debtholders can be approximated by calculating the yield to maturity of the debt outstanding (Koller et al., 2015). Given the fact that Tesla has a debt rating of B-, the cost of debt can be approximated more precisely by adding a corresponding debt spread to the risk-free rate. Given the relatively short duration of the debt as apparent in *Chapter 4.2.1 – Capital structure - Figure 17* the chosen risk free rate is 2,94%, based on a 5 year US treasury bond yield (Treasury.gov, 2019). Damodaran (2019 c) proposes to use a debt spread of 6,60% with a correstponding rating of B- if the market capitalization is larger than five billion USD. Therefore, Tesla has a total cost of debt of ***9,54%***.

The last variable missing that is needed for the WACC calculation is the *corporate tax rate*. Since Tesla historically reported only net losses for its full fiscal years, the company actually has a negative effective tax rate for these periods (Tesla, 2018 a). Given the fact that once Tesla turns profitable it has a positive effective tax rate, for valuation purposes, statutory corporate tax rates are applied.
Furthermore, because Tesla generates its revenues globally, different corporate tax rates have to be considered for its revenue streams. *Table 12* shows Tesla's geographic revenue distribution and applicable tax rates. Since the position "Other" of the geographical segmentation is not described in more detail by Tesla, it is assumed that the revenues of that position are mainly generated in Europe. Therefore, the average corporate tax rate for the European Union of 20,84% is taken.

Country	30.09.2018 YTD revenue total	30.09.2018 YTD revenue percentage	Corporate tax rates 2018
United States	9.249	65,0%	27,00%
China	1.445	10,2%	25,00%
Netherlands	627	4,4%	25,00%
Norway	611	4,3%	23,00%
Other	2.303	16,2%	20,84%
	14.235	100,0%	**25,54%**

Table 12: Tesla's revenue weighted corporate tax rate as of 2018 (Tesla, 2018 b & KPMG, 2019; own research)

The applicable tax rate for the WACC calculation is therefore ***25,54%***. For the debt and equity weights of the WACC, Tesla's market values for debt and equity are chosen for the same reason as for re-levering the peers' asset betas as well as to be overall consistent. *Table 13* recaps the big picture of Tesla's WACC composition.

Required return to equity	
Risk-free rate	3,19%
Adjusted equity beta	1,07
MRP	5,20%
CRP	0,10%
Total cost of equity	8,85%
Cost of debt	
risk free rate	2,94%
Credit Spread	6,60%
Total cost of debt	9,54%
Corporate tax rate	25,54%
Cost of debt after tax	7,103%
D/E ratio	17,81%
Debt ratio	15,12%
Equity ratio	84,88%
WACC	**8,193%**

Table 13: Composition of Tesla's WACC (own research)

The applicable WACC is ***8,193%.*** With the WACC being the expected minimum return for stakeholders outside of the company, the essential question to ask is if that return can actually be obtained with the assets and income of the company itself. That plausibility check can be undertaken by calculating the Return on capital employed (ROCE), where capital employed is the sum of fixed assets and the working capital. *Formula 26* depicts the computation of the ROCE (Vernimmen et al., 2018):

$$ROCE = \frac{EBIT * (1 - tax\ rate)}{Capital\ employed} \quad (26)$$

The comparison of the WACC and ROCE is crucial when it comes to the calculation of the terminal value. Ideally, WACC and ROCE converge towards time and have the same amount in the terminal value, implying that an economic profit cannot be sustained forever. Otherwise, if the WACC is greater than the ROCE in the TV, this indicates that the company enters a phase of decline and vice versa (Vernimmen et al., 2018).

5.7.2 Deriving the free cash flows to firm

The free cash flows to firm (FCFF) are the residual claims that are available to both equity and debtholders. Therefore, discounting all cash flows results in a net present value that accounts for the whole enterprise. Formula 27 [28] shows the derivation of the FCFF.

$$\begin{aligned} Free\ cash\ flow\ to\ firm &= EBIT * (1 - tax\ rate) + depreciation \\ &- capital\ expenditures - increase\ in\ working\ capital \end{aligned} \quad (27)$$

A mayor issue to address is the length and detail of the forecasting period, which is the time series of free cash flows that must be planned until the company's business model converges into a steady state where a perpetuity-based terminal value is applied. (Koller et al., 2015).
Since Tesla is as of the valuation date a high growth company with a compound annual revenue growth rate (CAGR) of 89% from financial year 2010 to 2018 it can be expected that this trend in revenue growth might continue for the years coming until revenues level off and the expected overall growth reaches a steady state (Damodaran, 2010). Therefore, to capture the transition from a high growth company to a business in steady state, a forecasting period of ***10 years*** is applied.
For a fully comprehensive analysis and to build the valuation model as dynamic as possible, a detailed breakdown of revenues and costs based on price and volume should be conducted (Koller et al., 2015). In the case of Tesla, the company only reports total vehicle deliveries but does not provide the applicable fraction of direct sales and leased vehicles as well as the leasing conditions. Furthermore, car selling

[28] Taken from *Berk & Demarzo (2017)*

prices vary per country and depend in each case on the individual equipment features. In addition, for Tesla's energy generation and storage segment there are no sales figures available at all. Therefore, a bottom up reconciliation of Tesla's revenues based on price and volume is not possible. Moreover, a detailed breakdown of input costs is also not feasible.

Since Tesla is a public company and analyst consensus is available, it is more efficient to build a simplified forecasting model with directly inputting the consensus data to arrive at a base case value. For a best-case and worst-case scenario, a more detailed planning regarding the input variables is conducted in the following chapters.

The missing part to derive all FCFFs after the forecasting period is the terminal value (TV), which is usually calculated using a perpetuity growth model as depicted by Formula 28 [29]. Therefore, the terminal value implies a going-concern assumption.

$$Terminal\ value = \frac{FCFF_{terminal\ value}}{WACC - g} \tag{28}$$

where g is the expected, sustainable, long run growth rate of the company's revenues or EBIT. That growth rate should be in line with the overall economic growth, since it is not possible to outperform the economy in infinity (Damodaran, 2015). As described in *Chapter 4.1.3 – Overall economic development*, the expected GDP growth for the year 2025 is 1,6% for the USA and 3,7% for the world in general. Therefore, the applicable growth rate for Tesla's revenues for the years 2028 onwards is chosen to be a presumed, conservative ***1,5%***. To subsequently calculate the enterprise value, all FCFFs and the terminal value have to be discounted and then added up as demonstrated by *Formula 29* [30]*:*

$$Enterprise\ value = \frac{FCFF_{t_1}}{(1+WACC)^{t_1}} + \frac{FCFF_{t_2}}{(1+WACC)^{t_2}} + \ldots + \frac{FCFF_{t_n} + TV}{(1+WACC)^{t_n}} \tag{29}$$

Since the valuation is performed for the 30th September 2018, the first FCFF has to be that of the ultimo 2018, discounted back 0,25 years, thereby taking into account the effect of the partial year. All other cashflows are discounted using the same principle, i.e. for t_2 1,25 years are applied.

5.7.3 Model extension to incorporate the probability of default

The standard DCF model assumes a pure going-concern assumption. While it can be presumed that the WACC already takes into account the probability of default by including a debt spread and debt beta, Damodaran (2009) argues that these risk components only consider the riskiness of future cash flows in a going-concern assumption, leaving out to adequately reflect the distress risk as truncation risk.

[29] Adopted from *Berk & Demarzo (2017)*
[30] Adopted from *Berk & Demarzo (2017)*

The most coherent approach to additionally incorporate the distress risk into the DCF Model seems to be to incorporate both a going-concern assumption as well as distress scenario (Damodaran, 2006 & 2010). Formula 30 [31] depicts that approach:

$$Expected\ Cash\ Flow\ in\ period\ t = CF_{going-concern,t} * (1 - PD_t) + CF_{distress,t} * PD_t \qquad (30)$$

With CF being the Cash Flow in period *t* and PD being the probability of default in period *t*. The cash flow in the distress scenario is derived from a liquidation value. Since the DCF model is set up to calculate the enterprise value in a first step, the liquidation value has as well to represent the firm value in a dissolution scenario. While there is no uniform framework on how to calculate the liquidation value, according to Damodaran (2010) the most practical solution is to calculate distressed sales proceeds based on a fraction of total assets. *Formula 31* shows the calculation of the liquidation value for the firm [32]:

$$Liquidation\ Value_{\ Firm\ ,t} = Total\ assets_{\ t} * (1 - haircut\ in\ percentage) \qquad (31)$$

The liquidation scenario implies the application of Chapter 7 under the Bankruptcy Code. The applicable haircut must therefore take into account a price reduction from the fire sale of the assets, the compensation for a bankruptcy trustee and legal as well as other professional fees (Altman and Hotchkiss, 2006). These costs represent both direct bankruptcy costs and indirect bankruptcy costs. Indirect bankruptcy costs further include opportunity costs such as suboptimal decisions by corporate stakeholders leading the firm into distress and loss of market share (Senbet and Wang, 2012; Opler and Titman, 1994). The difficult part is to estimate those costs. Senbet and Wang (2012) attribute direct costs of up to 5% of total pre-bankruptcy firm value for any industry while Hortacsu et al. (2013) estimate indirect ex ante costs of financial distress for car manufacturers based on their credit rating. A company with a credit rating of B is therefore assumed to have a value loss on its pre-bankruptcy firm value of 7,17%. This implies that Tesla with a credit rating of B- has indirect bankruptcy costs above 7% of its firm value.

The estimation of the applicable haircut for Tesla's assets is based on the following assumptions: As determined in *Chapter 5.6 – Historical figures analysis*, Tesla's assets are in a good condition and should therefore achieve a relatively high selling price. Furthermore, since Tesla is a technology leader, its assets might be sought after with high demand, leading to an increased price basis for negotiations as well as for an extended period of time to find potential buyers. The applied haircut is therefore chosen prudently to be **40%** of total assets.

[31] Adopted from *Damodaran (2006)*
[32] Own interpretation based on *Damodaran (2010)*

5.7.4 Base-case equity value

To derive a first robust valuation result, consensus analyst estimates from the data vendor S&P Capital IQ are utilized. These inputs for the key figures revenue, EBIT, depreciation and CAPEX are applied as data entries in the DCF model.

An important consideration to be made is to determine how much of the Tesla's total cash is actually needed for its operations. Opler et al. (1997) find that firms with stronger growth opportunities and riskier firms hold higher operative cash positions. Koller et al. (2015) consider any cash position above 2% of revenues as excess cash. Given that Tesla is a high growth company and does not pay out any dividends, it is assumed that any cash above 5% of revenues is considered as excess cash.

The forecasts for the operating working capital are derived as 30% margin of revenues, taking into account that the average operating working capital for the years 2013 until 2017 is 30% of revenues for that period. Tesla's total assets are as well expected to grow proportionally to total revenue.

For the terminal value, the free cash flow has to be normalized. Therefore, CAPEX and depreciation are offset against each other, since it is not realistic that expenditures on property, plant and equipment are higher than the write-offs for the same items in infinity (Vernimmen et al., 2018; Fernandez and Bilan, 2019). Furthermore, the terminal value implies a going-concern assumption since from a mathematical perspective, by applying the perpetuity formula the implication is that the company exists forever. Therefore, taking a probability of default into account in the terminal value seems to lead to a consistency breach. Hence, the FCF for the terminal value does not incorporate a distress scenario.

Lastly, as laid out in *Chapter 5.7.1 – Cost of capital* the ROCE is in the base case valuation below the WACC, indicating that Tesla enters a phase of decline in the long run, which is methodically consistent with the assumed level of distress. *Table 14* shows the derivation of Tesla's enterprise value [33].

[33] The full model with all figures and model inputs is depicted in *Appendix 7*

DCF Model -Base Case **In million USD**	*Adjusted* **2018**	*Forecast* **2019**	*Forecast* **2020**	*Forecast* **2021**	*Forecast* **2022**	*Forecast* **2023**	*Forecast* **2024**	*Forecast* **2025**	*Forecast* **2026**	*Forecast* **2027**	*Forecast* **2028**	*Forecast* **TV**
EBIT	(780)	(553)	963	2.142	4.073	4.245	5.334	6.296	7.429	8.543	9.312	9.452
YOY % change		-29%	na	122%	90%	4%	26%	18%	18%	15%	9%	1,5%
Tax rate		0%	25,5%	25,5%	25,5%	25,5%	25,5%	25,5%	25,5%	25,5%	25,5%	25,5%
EBIT after tax	(780)	(553)	717	1.595	3.033	3.160	3.972	4.688	5.531	6.361	6.934	7.038
YOY % change		-29%	na	122%	90%	4%	26%	18%	18%	15%	9%	1,5%
Total Depreciation & Amortisation	(2.016)	(2.077)	(2.217)	(2.437)	(2.687)	(2.630)	(2.732)	(2.819)	(2.185)	(2.175)	(2.250)	(2.284)
YOY % change		3%	7%	10%	10%	-2%	4%	3%	-22%	0%	3%	1,5%
Capital Expenditures	(7.754)	(1.817)	(2.676)	(3.009)	(3.204)	(3.345)	(3.467)	(3.525)	(3.372)	(3.444)	(3.584)	(2.284)
YOY % change		-77%	47%	12%	6%	4%	4%	2%	-4%	2%	4%	-36%
Operating Working Capital	(3.873)	(7.390)	(9.093)	(11.311)	(14.037)	(15.745)	(18.829)	(20.623)	(23.540)	(25.679)	(27.591)	(28.005)
YOY % change		91%	23%	24%	24%	12%	20%	10%	14%	9%	7%	1,5%
Change in Working Capital	11	(3.516)	(1.703)	(2.218)	(2.726)	(1.708)	(3.085)	(1.794)	(2.917)	(2.139)	(1.912)	(1.941)
Free Cash Flow to Firm	***(10.538)***	***(3.809)***	***(1.445)***	***(1.196)***	***(210)***	***738***	***152***	***2.188***	***1.427***	***2.954***	***3.688***	***5.097***
Probability of default	3,8%	3,8%	5,5%	5,9%	4,9%	4,4%	4,0%	3,2%	2,7%	2,5%	2,0%	
FCFF going concern assumption	(10.134)	(3.663)	(1.366)	(1.125)	(200)	705	146	2.119	1.389	2.880	3.616	5.097
Total assets	45.553	59.117	72.742	90.490	112.299	125.959	150.635	164.984	188.323	205.433	220.728	
FCFF liquidation assumption	1.050	1.362	2.387	3.225	3.315	3.348	3.588	3.118	2.994	3.057	2.583	
WACC	8,2%	8,2%	8,2%	8,2%	8,2%	8,2%	8,2%	8,2%	8,2%	8,2%	8,2%	8,2%
ROCE	-3,4%	-1,7%	1,8%	3,3%	5,0%	4,6%	4,9%	5,2%	5,4%	5,7%	5,8%	5,8%
Discount Factor	0,98	0,91	0,84	0,77	0,72	0,66	0,61	0,57	0,52	0,48	0,45	6,67
PVs of FCFs	(8.907)	(2.085)	856	1.626	2.229	2.681	2.283	2.959	2.289	2.866	2.765	33.974
Enterprise value as of 30.09.2018	***43.535***											

Table 14: Calculation of the base case enterprise value

(S&P IQ, 2019; own calculations, assumptions and table)

As of 30th September 2018, Tesla has an enterprise value of 43,54 billion USD based on the intrinsic valuation. That valuation result represents a point estimate, whereby under changing conditions and assumptions as well as variations of input parameters the valuation outcome alters accordingly. The following two chapters deal with changes in the input parameters. At the moment, the question to address is how to reconcile the total enterprise value to an equity value per share. *Figure 25* shows the transition stepwise:

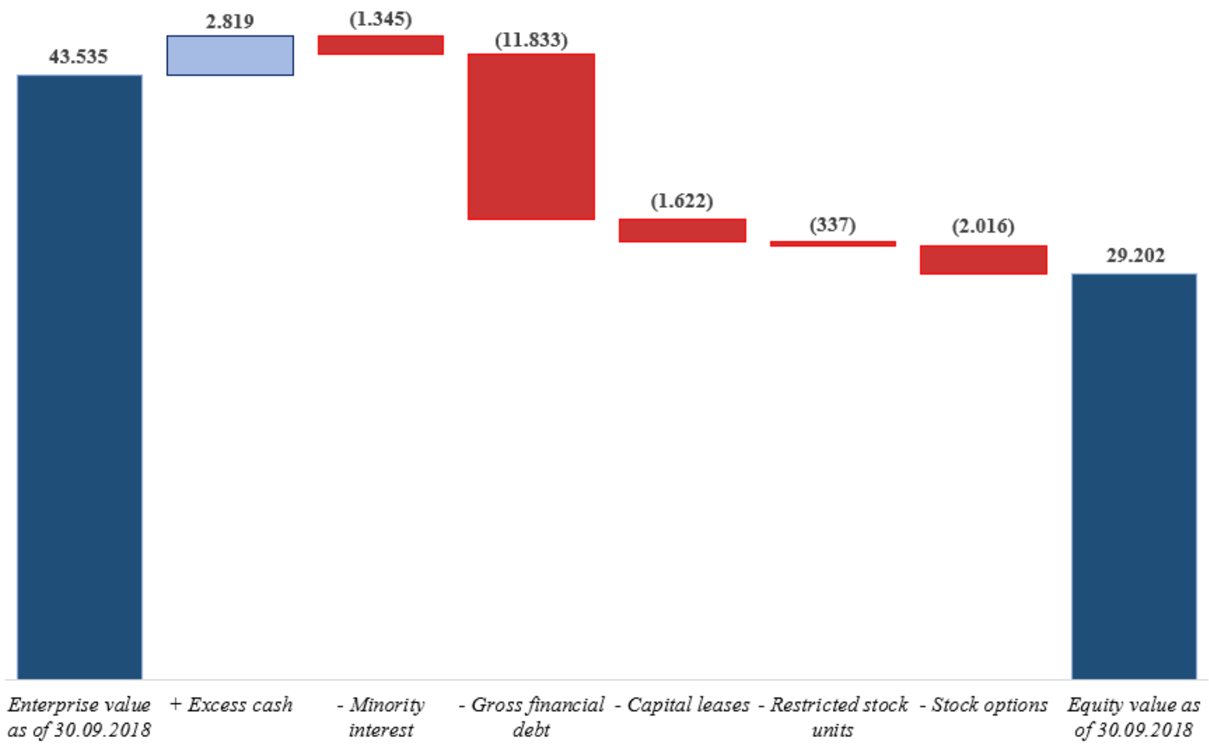

Figure 25: Value bridge from enterprise value to equity value
(S&P Capital IQ, 2019 & Koller et al., 2015; own graph)

The resulting equity value as of 30th September 2018 is 29,20 billion USD. As discussed in *Chapter 4.2.1 - Capital structure*, since the equity components of the restricted stock units as well as the stock options are already deducted from the enterprise value in the value bridge above, the resulting equity value is free of any dilutive effects. Therefore, with Tesla having as of the valuation date 171.732.775 shares of common stock outstanding, the equity value per share is **170,04 USD.**

5.7.5 Sensitivity analysis

The following section tests the DCF model from the prior chapter on key input changes and the corresponding variation in the final output, which is the value per share. The main purpose of the sensitivity analysis is to address the principal value drivers that influence the valuation result (Koller et al., 2015).

Although the forecasting period is ten years, the present value of the terminal value contributes 78% to the total enterprise value in the base case model. Therefore, changes in the inputs for the terminal value have the strongest impact on the valuation outcome. The subsequent analysis depicts the impact of a change in input variables on the value per share of Tesla's stock.

Table 15 shows the impact on the value per share for a 1% change in the WACC as well as a 0,5% change in the growth assumption for the terminal value. While a higher WACC leads to a lower valuation result, the opposite effect is true for the terminal value growth rate.

WACC \ TV growth rate	**0,5%**	**1,0%**	**1,5%**	**2,0%**	**2,5%**
6,2%	267	295	330	372	426
7,2%	195	214	236	262	293
8,2%	143	155	**170,04**	187	207
9,2%	102	112	122	134	147
10,2%	71	78	85	93	103

Table 15: Sensitivity analysis on WACC and TV growth rate
(S&P Capital IQ, 2019; own calculations and table)

In *Table 16* the effect of a variation of the level of haircut, impacting the free cash flow to firm under the liquidation scenario as well as well as a change in the level of operating working capital is displayed. A higher haircut and higher operating working capital ultimately leads to a lower valuation result.

Operating WC in % of revenue \ Haircut in %	**30%**	**35%**	**40%**	**45%**	**50%**
20%	250	240	231	222	212
25%	219	210	201	191	182
30%	189	179	**170,04**	161	151
35%	158	149	140	130	121
40%	128	119	109	100	90

Table 16: Sensitivity analysis on the level of operating working capital and rate of haircut
(S&P Capital IQ, 2019; own calculations and table)

Table 17 shows the valuation impact resulting from a change in the tax rate as well as a change in the EBIT over all forecasting periods. Higher taxes reduce Tesla's equity value whereas a higher level of EBIT increases the valuation result.

EBIT \ Tax rate	15%	20%	26%	30%	35%
90%	95	77	56	40	22
95%	155	133	109	90	68
100%	225	199	**170,04**	147	121
105%	305	274	240	213	182
110%	396	360	320	288	252

Table 17: Sensitivity analysis on the level EBIT and tax rate
(S&P Capital IQ, 2019; own calculations and table)

5.7.6 Scenario analysis

In *chapter 5.7.4 – Base case equity value*, Tesla's equity value per share was derived as a point estimate. With analysts' consensus data incorporating both positive and negative expectations on the company's prospective future development and the derivation of the enterprise value as the expected value of the going-concern and gone-concern scenario, all information and potential states have been taken into account. Though, incorporating all available information into one condensed model neglects the bandwidth of probable valuation outcomes (Damodaran, 2012). Therefore, to address plausible limits for the bandwidth of valuation results a *best case* and *worst case* are hereafter introduced and considered separately.

5.7.6.1 Best-case scenario

The best-case scenario depicts Tesla's corporate future under ideal conditions. Even though all inputs into the DCF model are optimized, the optimization is limited by the assumptions that are derived in *chapters 3.2 – Business model* and *chapter 4 – Risk assessment.*
As laid out in *chapter 3.2.5 – Conclusion and outlook* Tesla's business model has the potential to be sustainable in the long run, laying a robust foundation for the best-case scenario. A limiting element on the revenue side might be the depicted increased competition as pointed out in *chapter 4.1 – Business risk*. The increase in competition might occur gradually from the year 2025 to 2030 and beyond. Therefore, there is no significant drop in revenues in any year to be expected. Furthermore, the general automotive industry outlook predicts a demand shift from gasoline and diesel powered cars to electric

vehicles in the years coming. This suggested development levels the effect of increased competition on Tesla's revenue forecasts. On the cost side, Tesla might profit in the long run from decreased input costs which lower its cost of goods sold. *Chapter 3.2.2 – Profit formula* argues that its COGS are actually lower than Ford's but Tesla needs to cut its selling, general and administrative expenses and improve its R&D spending. As the company matures gradually, it is expected that the overall costs can be reduced and therefore the EBIT margin improves. With strong sales in 2019 and 2020 as well as increased cost efficiencies Tesla might be able to break even on its EBIT in 2020 and reach a EBIT margin of 12% in 2028, which is above e.g. BMW's EBIT margin of 9,9% as of ultimo 2017 but a definitely reachable goal. Under the assumption that Tesla earns a positive EBIT from 2020 onwards, the cost of debt could drop from 7,1% to 1,5% ceteris paribus and therefore the total WACC might decrease to 7,5%.

An aggressive revenue growth comes in hand with an increased need for investments in fixed assets such as production facilities. Therefore, CAPEX is chosen quite high for the years 2019 and 2020 to take into account the costs for a fast completion of the Gigafactories. After 2020, there is a significant drop in CAPEX, levelling off to 3% in 2028.

As Tesla improves its business model over time, it is assumed that also the operating working capital is enhanced, scaling it down from 30% of revenue in 2019 to 22% of revenue in 2028. Moreover, the assumptions for the terminal value are the same as for the base case. *Table 18* shows the calculation of the enterprise value as well as the equity value per share under the best-case scenario. The transition from enterprise value to equity value is unchanged compared to the base-case.

Incorporating optimal conditions for Tesla's corporate future suggests that one share of the company's stock might be worth **360 USD**, depicting the upper bound of the valuation range.

Input fields are coloured blue

DCF Model - Best case **In million USD** (except value per share)	*Adjusted* **2018**	*Forecast* **2019**	*Forecast* **2020**	*Forecast* **2021**	*Forecast* **2022**	*Forecast* **2023**	*Forecast* **2024**	*Forecast* **2025**	*Forecast* **2026**	*Forecast* **2027**	*Forecast* **2028**	*Forecast* **TV**
Total Revenue	18.981	30.369	47.072	68.254	94.873	123.335	154.169	177.294	196.796	212.540	227.418	230.829
YOY % change		60%	55%	45%	39%	30%	25%	15%	11%	8%	7%	
EBIT	(780)	(304)	471	1.024	2.846	4.933	8.479	12.411	16.728	21.254	27.290	
EBIT margin		-1,0%	1,0%	1,5%	3,0%	4,0%	5,5%	7,0%	8,5%	10,0%	12,0%	
Tax rate		0,0%	25,5%	25,5%	25,5%	25,5%	25,5%	25,5%	25,5%	25,5%	25,5%	25,5%
EBIT after tax	(780)	(304)	350	762	2.119	3.673	6.314	9.241	12.455	15.826	20.320	20.625
Total Depreciation & Amortisation	(2.016)	(5.466)	(5.649)	(6.825)	(6.641)	(4.933)	(7.708)	(5.319)	(5.904)	(6.376)	(4.548)	(4.617)
D & A in % of revenue		18%	12%	10%	7%	4%	5%	3%	3%	3%	2%	
Capital Expenditures	(7.754)	(15.184)	(21.182)	(13.651)	(14.231)	(14.800)	(12.333)	(8.865)	(9.840)	(10.627)	(6.823)	(4.617)
CAPEX in % of revenue		50%	45%	20%	15%	12%	8%	5%	5%	5%	3%	
Operating Working Capital	(3.873)	(9.111)	(13.180)	(17.746)	(23.718)	(29.600)	(33.917)	(39.005)	(43.295)	(46.759)	(50.032)	(50.782)
OWC in % of revenue		30%	28%	26%	25%	24%	22%	22%	22%	22%	22%	
Change in Working Capital	11	(5.237)	(4.069)	(4.566)	(5.972)	(5.882)	(4.317)	(5.088)	(4.291)	(3.464)	(3.273)	(3.322)
Free Cash Flow to Firm	***(10.538)***	***(15.259)***	***(19.253)***	***(10.629)***	***(11.443)***	***(12.076)***	***(2.628)***	***607***	***4.229***	***8.111***	***14.773***	***17.303***
Probability of default	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	
FCFF	(10.538)	(15.259)	(19.253)	(10.629)	(11.443)	(12.076)	(2.628)	607	4.229	8.111	14.773	17.303
WACC	8,2%	8,2%	8,2%	7,7%	7,7%	7,7%	7,7%	7,7%	7,7%	7,7%	7,7%	7,7%
Discount Factor	0,98	0,91	0,84	0,78	0,72	0,67	0,62	0,58	0,54	0,50	0,46	7,46
PVs of FCFs	(10.333)	(13.829)	(16.127)	(8.267)	(8.263)	(8.097)	(1.636)	351	2.270	4.042	6.836	129.136
Enterprise value as of 30.09.2018	***76.084***											
+ Excess cash	2.819											
- Minority interest	(1.345)											
- Gross financial debt	(11.833)											
- Capital leases	(1.622)											
- Restricted stock units	(337)											
- Stock options	(2.016)											
Equity value as of 30.09.2018	***61.751***											
Shares outstanding	171.732.775											
Value per share	**359,57**											

Table 18: Calculation of the best-case equity value per share

(S&P Capital IQ, 2019; own calculations, assumptions and table)

5.7.6.2 Worst-case scenario

In the worst-case scenario Tesla is not able to materialize a stable business, facing problems to grow its revenues fast enough and being not able to reach a positive EBIT. A number of factors such as arising severe problems regarding the electric vehicles technology with subsequent recall campaigns, a delay of production due to natural disasters or the potential dismissal of Elon Musk as CEO of Tesla might trigger a downward trend that could suddenly end Tesla's corporate existence. As pointed out in *chapter 4.2.2 – Distress risk*, Tesla currently has narrow margin for error from a financial perspective.

In the constructed worst-case scenario, Tesla runs out of cash most likely in 2021 and cannot meet its debt obligations. Since no debt or equity investor is willing to refinance the company, Tesla has to file for chapter 7 bankruptcy, in which case the company is liquidated. Total assets as well as the applicable haircut are the same as in the base case scenario with 240% of total revenue and 40%, respectively. Since Tesla's management might already anticipate the bad state well beforehand in the year 2019, CAPEX is cut to zero for 2020 and 2021. The operating working capital decreases to 5% of revenue in 2021 as Tesla is unable to pay the majority of its account payables and other short-term liabilities. The probability of default rises significantly in 2020 and is recognized with a higher WACC of 9,2%. In 2021 the likelihood of bankruptcy is greater than 80%, leading to a WACC of above 10%.

The resulting liquidation value for Tesla is 21,1 billion USD in 2021. The enterprise value as of the valuation date is 14,7 billion USD. After deducting net debt and debt like items the resulting equity value per share close to zero, leaving Tesla's shares worthless. *Table 19* shows the inputs and calculations to receive the equity value per share in the worst-case scenario.

Input fields are coloured blue

DCF Model - Worst case in million USD (except value per share)	*Adjusted* **2018**	*Forecast* **2019**	*Forecast* **2020**	*Forecast* **2021**
Total Revenue	18.981	22.777	26.193	23.574
YOY % change		20%	15%	-10%
EBIT	(780)	(228)	(2.619)	(7.072)
EBIT margin		-1,0%	-10,0%	-30,0%
Tax rate		0,0%	0,0%	0,0%
EBIT after tax	(780)	(228)	(2.619)	(7.072)
Total Depreciation & Amortisation	(2.016)	(1.822)	(2.357)	(3.536)
D & A in % of revenue		8%	9%	15%
Capital Expenditures	(7.754)	(1.817)	0	0
CAPEX in % of revenue		8%	0%	0%
Operating Working Capital	(3.873)	(6.833)	(5.239)	(1.179)
OWC in % of revenue		30%	20%	5%
Change in Working Capital	11	(2.960)	1.594	4.060
Free Cash Flow to Firm	***(10.538)***	***(3.183)***	***1.332***	***524***
Probability of default	3,8%	3,8%	10,0%	82,3%
FCFF	(10.134)	(3.060)	1.199	93
Total assets	45.553	54.664	62.864	56.577
FCFF liquidation assumption	1.050	1.259	3.772	27.945
WACC	8,2%	8,2%	9,2%	10,2%
Discount Factor	0,98	0,91	0,83	0,75
PVs of FCFs	(8.907)	(1.632)	4.126	21.117
Enterprise value as of 30.09.2018	***14.704***			
+ Excess cash	2.819			
- Minority interest	(1.345)			
- Gross financial debt	(11.833)			
- Capital leases	(1.622)			
- Restricted stock units	(337)			
- Stock options	(2.016)			
Equity value as of 30.09.2018	***370***			
Shares outstanding	171.732.775			
Value per share	***2,15***			

Table 19: Calculation of the worst-case equity value per share
(S&P Capital IQ, 2019; own calculations, assumptions and table)

5.7.7 DCF valuation summary

Figure 26 summarizes the evolvement of revenues and EBITs for all considered states graphically. In *Figure 27* the valuation outcomes are compared in terms of total enterprise values and opposed with the corresponding total equity values in billion USD. While on the one hand the three cases yield a very broad valuation range, indicating a value per share between USD 2,15 and 359,17 it has to be pointed out that the best and worst case are extremes and therefore unlikely that these states will actually materialize. The base-case with a value per share of USD 170,04 is quite in the middle of the range and therefore the best indication for the intrinsic value of Tesla's shares as of 30th September 2018.

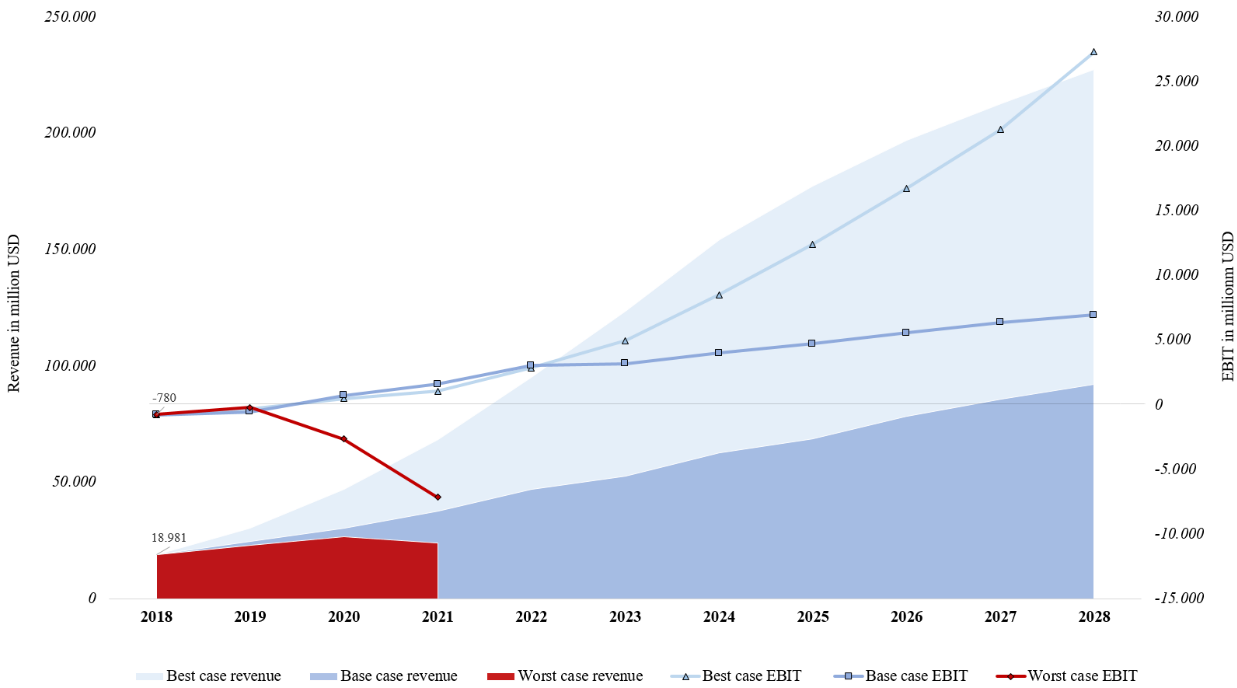

Figure 26: Revenue and EBIT comparison for all cases (S&P Capital IQ, 2019; own graph)

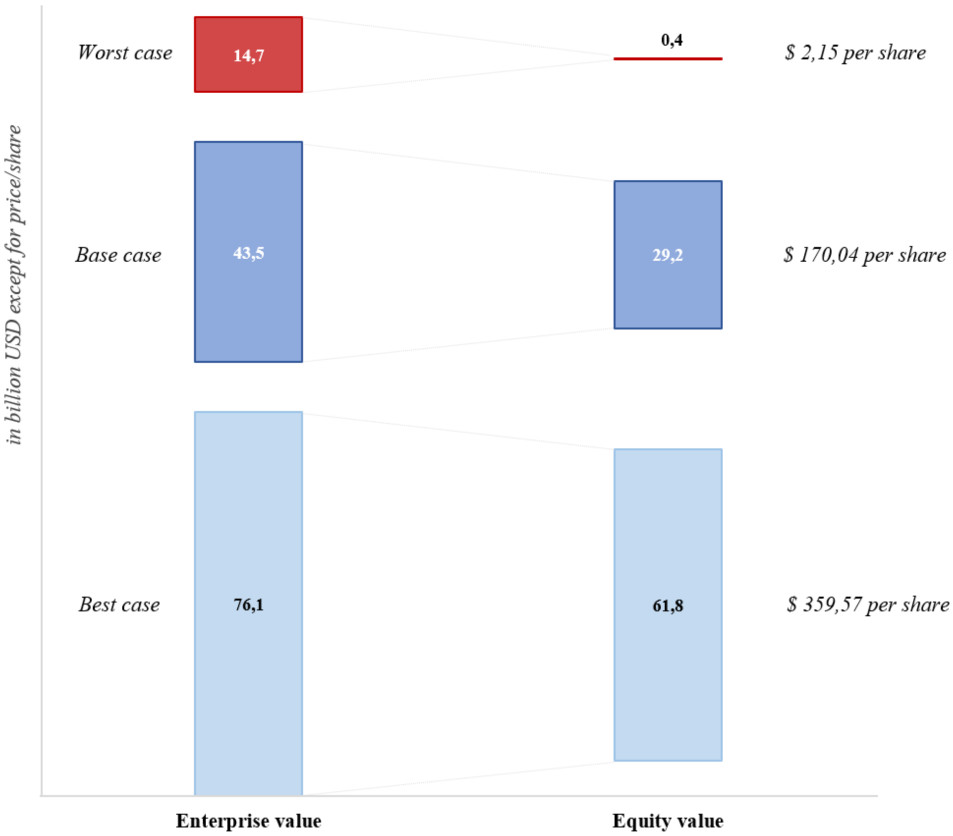

Figure 27: Valuation outcome comparison for all cases (S&P Capital IQ, 2019; own graph)

5.8 Relative valuation

In the penultimate chapter of the thesis, the intrinsic valuation results derived via the DCF method are tested for their resilience against applicable, observable inputs from comparable companies.

5.8.1 Purpose and use of multiples

The basic idea of relative valuation and therefore multiples is that companies that are similar in respect to their business model and risk, growth expectations as well as asset base to the company to value should sell for similar prices. By applying specific ratios of these comparable companies e.g. Price-to-Earnings ratio (P/E ratio) to the valuation object, market-based valuations of these companies can be incorporated and furthermore scaled to fit the specifics of Tesla (Koller et al., 2015).

There are two main categories of multiples to distinguish: *Trading* and *transaction multiples;* While trading multiples require that the comparable companies are traded on a stock exchange to observe the market-based valuation in terms of price per share or total enterprise value, transaction multiples reflect actual prices paid in precedent M&A transactions. Since the latter might include control premiums as well as potential synergies, it seems not appropriate to use transaction multiples to value Tesla's shares (Rosenbaum and Pearl, 2009).

Damodaran (2012) argues that when defining multiples, it is essential that the multiples are consistent, meaning that the numerator as well as the denominator have to incorporate equity values or enterprise values. Therefore, e.g. a Price-to-EBIT multiple should not be constructed since price is an equity value and EBIT is a residual revenue stream used for both equity as well as debt investors.

5.8.2 Application and selection of multiples

Valuation with multiples requires in a very first step a selection of comparable companies. The applicable peer group has already been chosen in chapter *5.3 – Peer group*.

While not all multiples suite all companies or industries, choosing multiples to apply to Tesla's financials as of 30th September 2018 poses a difficulty since the company has a negative EBIT, EBITDA as well as net profit. Therefore, P/E multiples as well as EV/EBIT and EV/EBITDA multiples are not applicable. Furthermore, the application of specific multiples is as well limited by the availability of comparable financial data of the peer group. To derive a conclusive valuation result the following multiples are considered:

1.) *Total enterprise value–to-total revenues*; The revenues of the peer group as well as of Tesla are based on last twelve months (LTM) as well as next twelve months (NTM).

2.) *Price-to-tangible book value per share,* where tangible book value is total common equity minus goodwill and other intangibles.

Table 20 shows the chosen multiples for every peer as well as specified metrics e.g. average of the peer group multiples.

Industry	Peer company	EV/Total Revenues LTM	EV/Total Revenues NTM	P/Tangible BV LTM
Automobile	BAIC Motor Corporation Limited (SEHK:1958)	0,3x	0,3x	1,6x
	BYD Company Limited (SEHK:1211)	1,7x	1,5x	3,0x
	Bayerische Motoren Werke Aktiengesellschaft (DB:BMW)	1,4x	1,4x	0,9x
	Daimler AG (XTRA:DAI)	1,1x	1,0x	1,0x
	Ford Motor Company (NYSE:F)	1,0x	1,1x	1,0x
	General Motors Company (NYSE:GM)	0,9x	0,9x	1,5x
	Peugeot S.A. (ENXTPA:UG)	0,2x	0,2x	6,1x
	Volkswagen AG (XTRA:VOW3)	0,9x	0,9x	1,5x
High Tech	Alphabet Inc. (NasdaqGS:GOOG.L)	5,9x	4,9x	5,9x
	Apple Inc. (NasdaqGS:AAPL)	4,4x	4,1x	9,5x
	Intel Corporation (NasdaqGS:INTC)	3,5x	3,3x	6,5x
	Microsoft Corporation (NasdaqGS:MSFT)	7,5x	6,8x	22,5x
	NVIDIA Corporation (NasdaqGS:NVDA)	13,9x	12,2x	21,0x
	Panasonic Corporation (TSE:6752)	0,4x	0,4x	3,1x
Solar	First Solar, Inc. (NasdaqGS:FSLR)	1,0x	0,8x	1,0x
	Minimum	***0,2x***	***0,2x***	***0,9x***
	Maximum	***13,9x***	***12,2x***	***22,5x***
	25% quartile	***0,9x***	***0,9x***	***1,3x***
	75% quartile	***4,0x***	***3,7x***	***6,3x***
	Average	***2,9x***	***2,6x***	***5,7x***
	Median	***1,1x***	***1,1x***	***3,0x***

Table 20: Peer group multiples
(S&P IQ, 2019; partially own calculations)

5.8.3 Relative valuation summary

Table 21 shows the resulting equity values per share by applying the peer group multiples. To calculate the equity value starting with the enterprise value, the same value bridge as depicted in *Figure 25* in *chapter 5.7.2 – Deriving the free cash flows to firm* is applied. For the total revenues next twelve months (NTM) the base case total revenue of 2019 is applied.

Equity value per share in USD	**EV/Total Revenues LTM**	**EV/Total Revenues NTM**	**P/Tangible BV LTM**
Minimum	-63	-55	19
Maximum	1335	1665	464
25% quartile	8	38	26
75% quartile	320	447	130
Average	217	296	118
Median	29	80	62

Table 21: Relative valuation results
(S&P Capital IQ, 2019; own calculations)

The resulting valuation range is very broad. One could argue on the first sight that the results are little meaningful, justifying that the chosen peers are selected incorrectly. However, as described in *Chapter 3.2 – Business model,* Tesla's products and technology are not directly comparable with any one company, leading to the challenge to build a peer group by adding companies with different technological- and business model components to replicate Tesla's business model, growth prospects and risk characteristics. Therefore, the major drivers in the broad valuation range can be up and foremost attributed to specific differences between peers of the automobile and high-tech industry, resulting in significantly higher multiples in the high tech industry as depicted in *Table 20: Peer group multiples.*
Consequently, applying the minimum, maximum as well as median equity values lead to a distorted picture regarding the value of Tesla's equity. Applying the 25%, 75% quartile as well as the average allow for a more consistent and narrower illustration of a representative bandwidth of Tesla's equity value. The total valuation results of the quartiles range from *USD 8,37 per share* to *USD 446,52 per share*.

6 Conclusion and outlook

This final part of the thesis tries to answer the predominant research question, formulated in *chapter 1.2 – Research questions:*
What is the fundamental value of one share of Tesla's equity as of September 30, 2018?
The answer to this question is that depending on the respective assumptions, there exists a quite broad range of potential equity values for Tesla's shares as of September 30, 2018 with the most likely fundamental value being approximately 170 dollars per share. *Figure 28* summarizes the valuation outcomes and contrasts it with Tesla's actual share price.
With all three DCF cases being supported by the relative valuation only the best case is supported by the 1-year share price range of Tesla. Narrowing down the relative valuation approach, it can be observed that only the base case of the DCF result is supported by the range of the average of the EV/Total Revenues NTM multiple, being the upper bound and the average of the Price/Tangible BV LTM multiple being the lower bound.
The average valuation outcome of all three multiples implies a share price of USD 210 per share, leading to a slightly higher valuation than the base case DCF result of USD 170 per share. Both the fundamental valuation's as well as the relative valuation's point estimate indicate that Tesla´s share prices of USD 265 on 28th September 2018 and USD 311 on 1St October 2018 cannot be supported and therefore imply that Tesla's stock might be overvalued by the market as of the valuation date.

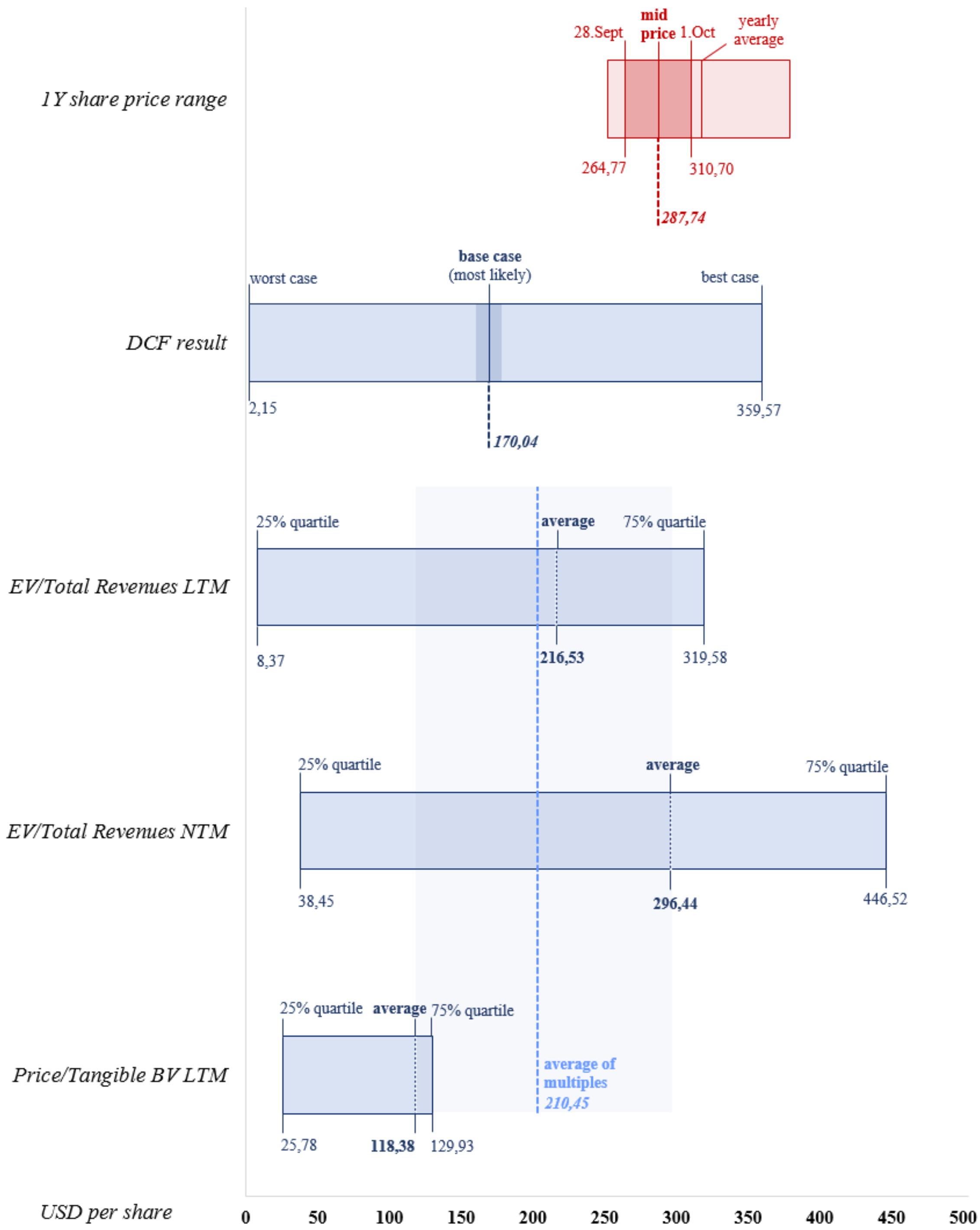

Figure 28: Valuation summary

(S&P IQ, 2019; own graph)

To give an outlook and test whether the market participants price Tesla's shares different after the valuation date, *Figure 29* depicts Tesla's share price one year ahead of the valuation date. It can be noted that shortly after the valuation date the share price drops to USD 251 per share on October 8, 2018 but afterwards rapidly recovers. Nevertheless, there is a general downward trend in the year following the valuation date, indicating that Tesla's stock was overvalued by the market as of 30th September 2018 and that the market seemingly corrected its beliefs about the value of Tesla's stock.

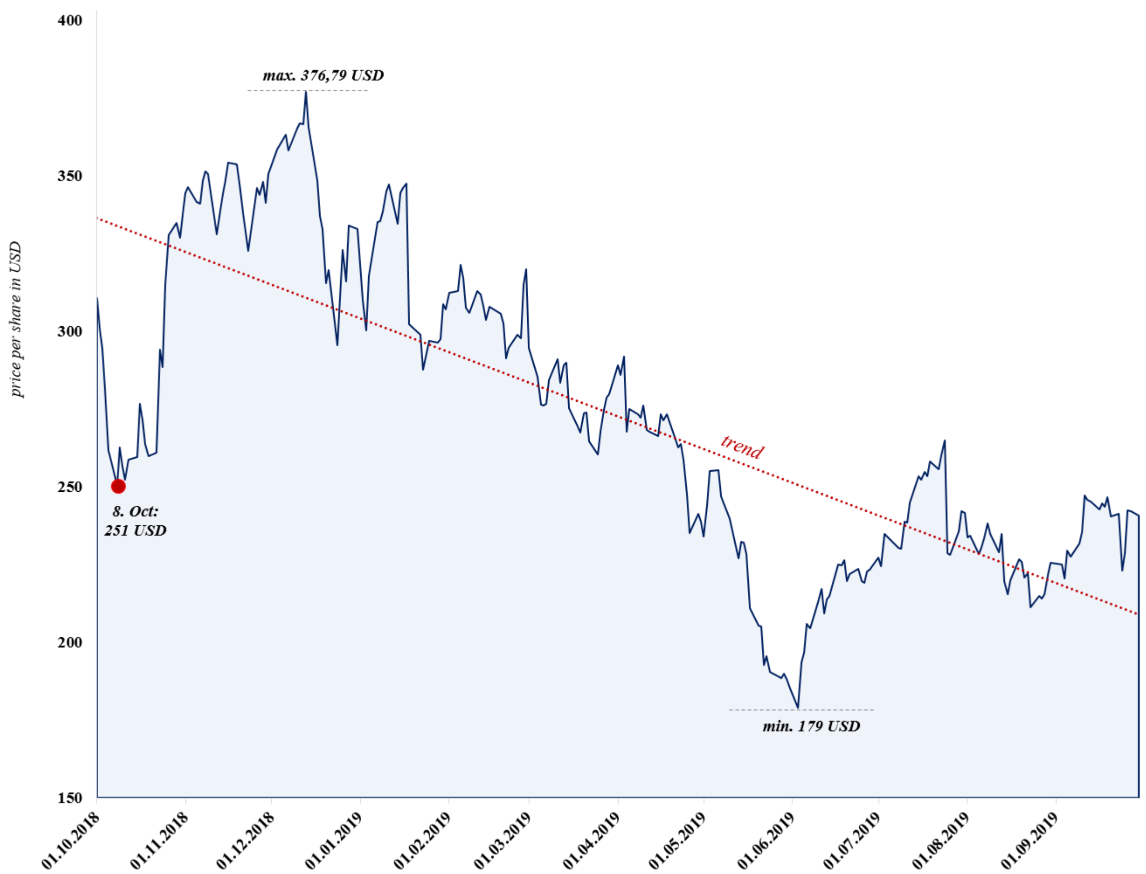

Figure 29: Tesla share price outlook

(S&P IQ, 2019; own graph)

This thesis evaluated Tesla's equity value per share at a quite exciting point in time as well as stage in the company's life cycle. It will be thrilling to follow Tesla's corporate future and observe how this interesting company and its stock price emerges over time, probably raising new issues to be examined.

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Appendix 1

Ford Q3 2018 report

P&L in million USD	YTD 30.09.2018 total	Adjustments to comply with Tesla	Explanation
Total revenues	=118545+387	+387	387 is Royalty income (reclassyfied from other income)
Costs of goods sold	=-100515-7052+58+66	-7052+58+66	7.052 is credit interest, operating, and other expenses; Credit interest originates from leasing plans to retail consumers which is considered a
Selling, general and administrative	-8407		
Research and development	=-58-66	-58-66	58 is development costs for Ford Smart Mobility and 66 is development costs for Autonomous Vehicles, both was accounted in COGS
Restructuring and other	0		
Interest income	=482+28+252+136	+482+28+252+136	482 is investment-related interest income that was previously allocated to other income, 28 is interest income that was previously allocated to other income, 252 is net income of affiliated companies, 136 is realized and unrealized gains on cash equivalents, marketable securities and other securities
Interest expense	=-890-43	-43	43 is interest expense on other debt
Other income (expense)	=2472-482-28-387-136	-482-28-387-136	
Provision for income taxes	-555		
Sum	3807		

Appendix 2

Beta Derivation

Pricing Date	NASDAQ:TSLA ($)	S&P 500	TSLA monthly return	S&P 500 weekly return	NASDAQ weekly returns
30.09.2016	204,0300	2.168,2721			
07.10.2016	196,6100	2.153,7394	-3,6%	-0,7%	-0,4%
14.10.2016	196,5100	2.132,9785	-0,1%	-1,0%	-1,5%
21.10.2016	200,0900	2.141,1619	1,8%	0,4%	0,8%
28.10.2016	199,9700	2.126,4076	-0,1%	-0,7%	-1,3%
04.11.2016	190,5600	2.085,1764	-4,7%	-1,9%	-2,8%
11.11.2016	188,5600	2.164,4508	-1,0%	3,8%	3,8%
18.11.2016	185,0200	2.181,9018	-1,9%	0,8%	1,6%
25.11.2016	196,6500	2.213,3486	6,3%	1,4%	1,5%
02.12.2016	181,4700	2.191,9537	-7,7%	-1,0%	-2,7%
09.12.2016	192,1800	2.259,5287	5,9%	3,1%	3,6%
16.12.2016	202,4900	2.258,0724	5,4%	-0,1%	-0,1%
23.12.2016	213,3400	2.263,7887	5,4%	0,3%	0,5%
30.12.2016	213,6900	2.238,8267	0,2%	-1,1%	-1,5%
06.01.2017	229,0100	2.276,9814	7,2%	1,7%	2,6%
13.01.2017	237,7500	2.274,6377	3,8%	-0,1%	1,0%
20.01.2017	244,7300	2.271,3147	2,9%	-0,1%	-0,3%
27.01.2017	252,9500	2.294,6897	3,4%	1,0%	1,9%
03.02.2017	251,3300	2.297,4159	-0,6%	0,1%	0,1%
10.02.2017	269,2300	2.316,0971	7,1%	0,8%	1,2%
17.02.2017	272,2300	2.351,1617	1,1%	1,5%	1,8%
24.02.2017	257,0000	2.367,3442	-5,6%	0,7%	0,1%
03.03.2017	251,5700	2.383,1170	-2,1%	0,7%	0,4%
10.03.2017	243,6900	2.372,5978	-3,1%	-0,4%	-0,2%
17.03.2017	261,5000	2.378,2531	7,3%	0,2%	0,7%
24.03.2017	263,1600	2.343,9781	0,6%	-1,4%	-1,2%
31.03.2017	278,3000	2.362,7182	5,8%	0,8%	1,4%
07.04.2017	302,5400	2.355,5450	8,7%	-0,3%	-0,6%
14.04.2017	304,0000	2.328,9533	0,5%	-1,1%	-1,2%
21.04.2017	305,6000	2.348,6950	0,5%	0,8%	1,8%
28.04.2017	314,0700	2.384,1955	2,8%	1,5%	2,3%
05.05.2017	308,3500	2.399,2857	-1,8%	0,6%	0,9%
12.05.2017	324,8100	2.390,8972	5,3%	-0,3%	0,3%
19.05.2017	310,8300	2.381,7267	-4,3%	-0,4%	-0,6%
26.05.2017	325,1400	2.415,8225	4,6%	1,4%	2,1%
02.06.2017	339,8500	2.439,0703	4,5%	1,0%	1,5%
09.06.2017	357,3200	2.431,7724	5,1%	-0,3%	-1,6%
16.06.2017	371,4000	2.433,1508	3,9%	0,1%	-0,9%
23.06.2017	383,4500	2.438,2969	3,2%	0,2%	1,8%
30.06.2017	361,6100	2.423,4089	-5,7%	-0,6%	-2,0%
07.07.2017	313,2200	2.425,1770	-13,4%	0,1%	0,2%

14.07.2017	327,7800	2.459,2710	4,6%	1,4%	2,6%
21.07.2017	328,4000	2.472,5359	0,2%	0,5%	1,2%
28.07.2017	335,0700	2.472,0985	2,0%	0,0%	-0,2%
04.08.2017	356,9100	2.476,8310	6,5%	0,2%	-0,4%
11.08.2017	357,8700	2.441,3202	0,3%	-1,4%	-1,5%
18.08.2017	347,4600	2.425,5522	-2,9%	-0,6%	-0,6%
25.08.2017	348,0500	2.443,0458	0,2%	0,7%	0,8%
01.09.2017	355,4000	2.476,5524	2,1%	1,4%	2,7%
08.09.2017	343,4000	2.461,4336	-3,4%	-0,6%	-1,2%
15.09.2017	379,8100	2.500,2259	10,6%	1,6%	1,4%
22.09.2017	351,0900	2.502,2222	-7,6%	0,1%	-0,3%
29.09.2017	341,1000	2.519,3597	-2,8%	0,7%	1,1%
06.10.2017	356,8800	2.549,3315	4,6%	1,2%	1,5%
13.10.2017	355,5700	2.553,1694	-0,4%	0,2%	0,2%
20.10.2017	345,1000	2.575,2059	-2,9%	0,9%	0,4%
27.10.2017	320,8700	2.581,0657	-7,0%	0,2%	1,1%
03.11.2017	306,0900	2.587,8361	-4,6%	0,3%	0,9%
10.11.2017	302,9900	2.582,3000	-1,0%	-0,2%	-0,2%
17.11.2017	315,0500	2.578,8543	4,0%	-0,1%	0,5%
24.11.2017	315,5500	2.602,4247	0,2%	0,9%	1,6%
01.12.2017	306,5300	2.642,2158	-2,9%	1,5%	-0,6%
08.12.2017	315,1300	2.651,5010	2,8%	0,4%	-0,1%
15.12.2017	343,4500	2.675,8080	9,0%	0,9%	1,4%
22.12.2017	325,2000	2.683,3373	-5,3%	0,3%	0,3%
29.12.2017	311,3500	2.673,6105	-4,3%	-0,4%	-0,8%
05.01.2018	316,5800	2.743,1478	1,7%	2,6%	3,4%
12.01.2018	336,2200	2.786,2441	6,2%	1,6%	1,7%
19.01.2018	350,0200	2.810,3027	4,1%	0,9%	1,0%
26.01.2018	342,8500	2.872,8678	-2,0%	2,2%	2,3%
02.02.2018	343,7500	2.762,1253	0,3%	-3,9%	-3,5%
09.02.2018	310,4200	2.619,5456	-9,7%	-5,2%	-5,1%
16.02.2018	335,4900	2.732,2198	8,1%	4,3%	5,3%
23.02.2018	352,0500	2.747,2985	4,9%	0,6%	1,4%
02.03.2018	335,1200	2.691,2528	-4,8%	-2,0%	-1,1%
09.03.2018	327,1700	2.786,5651	-2,4%	3,5%	4,2%
16.03.2018	321,3500	2.752,0118	-1,8%	-1,2%	-1,0%
23.03.2018	301,5400	2.588,2628	-6,2%	-6,0%	-6,5%
30.03.2018	266,1300	2.640,8660	-11,7%	2,0%	1,0%
06.04.2018	299,3000	2.604,4694	12,5%	-1,4%	-2,1%
13.04.2018	300,3400	2.656,2969	0,3%	2,0%	2,8%
20.04.2018	290,2400	2.670,1418	-3,4%	0,5%	0,6%
27.04.2018	294,0750	2.669,9063	1,3%	0,0%	-0,4%
04.05.2018	294,0900	2.663,4203	0,0%	-0,2%	1,3%
11.05.2018	301,0600	2.727,7159	2,4%	2,4%	2,7%
18.05.2018	276,8200	2.712,9747	-8,1%	-0,5%	-0,7%
25.05.2018	278,8500	2.721,3280	0,7%	0,3%	1,1%
01.06.2018	291,8200	2.734,6189	4,7%	0,5%	1,6%
08.06.2018	317,6600	2.779,0286	8,9%	1,6%	1,2%
15.06.2018	358,1700	2.779,6630	12,8%	0,0%	1,3%
22.06.2018	333,6300	2.754,8770	-6,9%	-0,9%	-0,7%

29.06.2018	342,9500	2.718,3735	2,8%	-1,3%	-2,4%
06.07.2018	308,9000	2.759,8219	-9,9%	1,5%	2,4%
13.07.2018	318,8700	2.801,3114	3,2%	1,5%	1,8%
20.07.2018	313,5800	2.801,8281	-1,7%	0,0%	-0,1%
27.07.2018	297,1800	2.818,8176	-5,2%	0,6%	-1,1%
03.08.2018	348,1700	2.840,3536	17,2%	0,8%	1,0%
10.08.2018	355,4900	2.833,2836	2,1%	-0,2%	0,3%
17.08.2018	305,5000	2.850,1316	-14,1%	0,6%	-0,3%
24.08.2018	322,8200	2.874,6891	5,7%	0,9%	1,7%
31.08.2018	301,6600	2.901,5177	-6,6%	0,9%	2,1%
07.09.2018	263,2400	2.871,6815	-12,7%	-1,0%	-2,6%
14.09.2018	295,2000	2.904,9754	12,1%	1,2%	1,4%
21.09.2018	299,1000	2.929,6672	1,3%	0,8%	-0,3%
28.09.2018	264,7700	2.913,9781	-11,5%	-0,5%	0,7%

Covariance (TSLA & S&P)

0,00024349

Variance (TSLA)

0,000217494

equity beta

1,12

Appendix 3

Derivation of the asset beta for Tesla's competitors

Pricing points in time	S&P 500 index value mathcing the date	Volkswagen prices	Volkswagen returns	BMW prices	BMW returns	Daimler prices	Daimler returns	Ford prices	Ford returns	General Motors prices	General Motors returns	Toyota prices	Toyota returns	Nissan prices	Nissan returns	Alphabet (Google) prices	Alphabet (Google) returns	Microsoft prices	Microsoft returns	Apple prices	Apple returns	Intel prices	Intel returns
t=0		116,95		74,85		62,71		12,07		31,77		5779		982,7		777.290		57,6		113,05		37.750	
t=1	-0,7%	118,55	1,4%	77,452	3,5%	63,87	1,8%	12,29	1,8%	32,34	1,8%	6006	3,9%	1013	3,1%	775.080	-0,3%	57,8	0,3%	114,06	0,9%	38.100	0,9%
t=2	-1,0%	120,6	1,7%	77,031	-0,5%	64,16	0,5%	11,91	-3,1%	31,87	-1,5%	5993	-0,2%	994	-1,9%	778.530	0,4%	57,42	-0,7%	117,63	3,1%	37.450	-1,7%
t=3	0,4%	123,25	2,2%	78,825	2,3%	64,62	0,7%	12,02	0,9%	32,04	0,5%	5972	-0,4%	1018	2,4%	799.370	2,7%	59,66	3,9%	116,6	-0,9%	35.150	-6,1%
t=4	-0,7%	125,95	2,2%	79,768	1,2%	65,34	1,1%	11,72	-2,5%	31,32	-2,2%	6043	1,2%	1051,5	3,3%	795.370	-0,5%	59,87	0,4%	113,72	-2,5%	34.740	-1,2%
t=5	-1,9%	118,7	-5,8%	75,639	-5,2%	61,85	-5,3%	11,34	-3,2%	31,16	-0,5%	5698	-5,7%	1011,5	-3,8%	762.020	-4,2%	58,71	-1,9%	108,84	-4,3%	33.610	-3,3%
t=6	3,8%	117,5	-1,0%	79,958	5,7%	64,77	4,7%	12,28	8,3%	34,02	9,2%	5952	4,5%	965,2	-4,6%	754.020	-1,0%	59,02	0,5%	108,43	-0,4%	34.610	3,0%
t=7	0,8%	117,15	-0,3%	80,849	1,1%	65,26	0,8%	11,76	-4,2%	33	-3,0%	6316	6,1%	1038,5	7,6%	760.540	0,9%	60,35	2,3%	110,06	1,5%	34.950	1,0%
t=8	1,4%	125,1	6,8%	82,605	2,2%	64,72	-0,8%	12,04	2,4%	34,25	3,8%	6689	5,9%	1087	4,7%	761.680	0,1%	60,53	0,3%	111,79	1,6%	35.440	1,4%
t=9	-1,0%	118,75	-5,1%	79,622	-3,6%	62,47	-3,5%	12,24	1,7%	35,41	3,4%	6686	0,0%	1074	-1,2%	750.500	-1,5%	59,25	-2,1%	109,9	-1,7%	34.160	-3,6%
t=10	3,1%	128,1	7,9%	89,391	12,3%	68,3	9,3%	13,17	7,6%	37,66	6,4%	7003	4,7%	1115	3,8%	789.290	5,2%	61,97	4,6%	113,95	3,7%	35.760	4,7%
t=11	-0,1%	131,2	2,4%	89,923	0,6%	70,62	3,4%	12,63	-4,1%	36,37	-3,4%	7155	2,2%	1167,5	4,7%	790.800	0,2%	62,3	0,5%	115,97	1,8%	36.310	1,5%
t=12	0,3%	137,5	4,8%	89,737	-0,2%	71,03	0,6%	12,46	-1,3%	35,69	-1,9%	7090	-0,9%	1212	3,8%	789.910	-0,1%	63,24	1,5%	116,52	0,5%	36.970	1,8%
t=13	-1,1%	133,35	-3,0%	88,814	-1,0%	70,72	-0,4%	12,13	-2,6%	34,84	-2,4%	6878	-3,0%	1175,5	-3,0%	771.820	-2,3%	62,14	-1,7%	115,82	-0,6%	36.270	-1,9%
t=14	1,7%	139	4,2%	90,6	2,0%	72,04	1,9%	12,76	5,2%	35,99	3,3%	6930	0,8%	1173	-0,2%	806.150	4,4%	62,84	1,1%	117,91	1,8%	36.480	0,6%
t=15	-0,1%	149,55	7,6%	87,542	-3,4%	71,33	-1,0%	12,63	-1,0%	37,34	3,8%	6882	-0,7%	1160	-1,1%	807.880	0,2%	62,7	-0,2%	119,04	1,0%	36.790	0,8%
t=16	-0,1%	148,2	-0,9%	86,734	-0,9%	70,64	-1,0%	12,36	-2,1%	37,01	-0,9%	6801	-1,2%	1150,5	-0,8%	805.020	-0,4%	62,74	0,1%	120	0,8%	36.940	0,4%
t=17	1,0%	149,9	1,1%	87,727	1,1%	70,72	0,1%	12,49	1,1%	37,01	0,0%	6704	-1,4%	1140,5	-0,9%	823.310	2,3%	65,78	4,8%	121,95	1,6%	37.980	2,8%
t=18	0,1%	144,9	-3,3%	84,339	-3,9%	67,65	-4,3%	12,56	0,6%	36,33	-1,8%	6445	-3,9%	1125,5	-1,3%	801.490	-2,7%	63,68	-3,2%	129,08	5,8%	36.520	-3,8%
t=19	0,8%	142,15	-1,9%	84,859	0,6%	67,12	-0,8%	12,51	-0,4%	35,17	-3,2%	6446	0,0%	1125,5	0,0%	813.670	1,5%	64	0,5%	132,12	2,4%	35.340	-3,2%
t=20	1,5%	140,25	-1,3%	84,819	0,0%	67,61	0,7%	12,58	0,6%	37,22	5,8%	6400	-0,7%	1116,5	-0,8%	828.070	1,8%	64,62	1,0%	135,72	2,7%	36.480	3,2%
t=21	0,7%	141,25	0,7%	84,15	-0,8%	68,76	1,7%	12,47	-0,9%	36,9	-0,9%	6448	0,8%	1112	-0,4%	828.640	0,1%	64,62	0,0%	136,66	0,7%	36.530	0,1%
t=22	0,7%	144,95	2,6%	87,216	3,6%	69,97	1,8%	12,65	1,4%	38,23	3,6%	6455	0,1%	1127,5	1,4%	829.080	0,1%	64,25	-0,6%	139,78	2,3%	35.900	-1,7%
t=23	-0,4%	141,45	-2,4%	83,482	-4,3%	70	0,0%	12,53	-0,9%	36,83	-3,7%	6520	1,0%	1158	2,7%	843.250	1,7%	64,93	1,1%	139,14	-0,5%	35.910	0,0%
t=24	0,2%	138,6	-2,0%	82,7	-0,9%	71,16	1,7%	12,48	-0,4%	36,33	-1,4%	6377	-2,2%	1132	-2,2%	852.120	1,1%	64,87	-0,1%	139,99	0,6%	35.270	-1,8%
t=25	-1,4%	135,8	-2,0%	83,472	0,9%	70,56	-0,8%	11,62	-6,9%	34,56	-4,9%	6229	-2,3%	1126	-0,5%	814.430	-4,4%	64,98	0,2%	140,64	0,5%	35.160	-0,3%
t=26	0,8%	136,6	0,6%	85,497	2,4%	69,2	-1,9%	11,64	0,2%	35,36	2,3%	6042	-3,0%	1073,5	-4,7%	829.560	1,9%	65,86	1,4%	143,66	2,1%	36.070	2,6%
t=27	-0,3%	132,9	-2,7%	83,146	-2,7%	67	-3,2%	11,23	-3,5%	33,71	-4,7%	5832	-3,5%	1010,5	-5,9%	824.670	-0,6%	65,68	-0,3%	143,34	-0,2%	36.030	-0,1%
t=28	-1,1%	131,15	-1,3%	82,635	-0,6%	66,42	-0,9%	11,11	-1,1%	33,39	-0,9%	5798	-0,6%	1012	0,1%	823.560	-0,1%	64,95	-1,1%	141,05	-1,6%	35.250	-2,2%
t=29	0,8%	140	6,7%	84,719	2,5%	66,17	-0,4%	11,34	2,1%	33,75	1,1%	5855	1,0%	1036	2,4%	843.190	2,4%	66,4	2,2%	142,27	0,9%	36.320	3,0%
t=30	1,5%	145,55	4,0%	87,532	3,3%	68,4	3,4%	11,47	1,1%	34,64	2,6%	6035	3,1%	1058,5	2,2%	905.960	7,4%	68,46	3,1%	143,65	1,0%	36.150	-0,5%
t=31	0,6%	144,2	-0,9%	89,29	2,0%	68,52	0,2%	11,14	-2,9%	33,77	-2,5%	6143	1,8%	1076,5	1,7%	927.130	2,3%	69	0,8%	148,96	3,7%	36.820	1,9%
t=32	-0,3%	144,65	0,3%	87,406	-2,1%	69,07	0,8%	10,92	-2,0%	33,62	-0,4%	6047	-1,6%	1107,5	2,9%	932.220	0,5%	68,38	-0,9%	156,1	4,8%	35.530	-3,5%
t=33	-0,4%	139,4	-3,6%	86,394	-1,2%	67,89	-1,7%	10,87	-0,5%	32,72	-2,7%	5965	-1,4%	1093,5	-1,3%	934.010	0,2%	67,69	-1,0%	153,06	-1,9%	35.400	-0,4%
t=34	1,4%	137,95	-1,0%	84,3	-2,4%	65,38	-3,7%	10,93	0,6%	33,07	1,1%	5941	-0,4%	1076	-1,6%	971.470	4,0%	69,96	3,4%	153,61	0,4%	36.260	2,4%
t=35	1,0%	137,55	-0,3%	86,143	2,2%	65,84	0,7%	11,35	3,8%	34,45	4,2%	6092	2,5%	1098	2,0%	975.600	0,4%	71,76	2,6%	155,45	1,2%	36.320	0,2%
t=36	-0,3%	132,6	-3,6%	84,539	-1,9%	65,46	-0,6%	11,13	-1,9%	34,34	-0,3%	5838	-4,2%	1076,5	-2,0%	949.830	-2,6%	70,32	-2,0%	148,98	-4,2%	35.710	-1,7%
t=37	0,1%	131,2	-1,1%	83,5	-1,2%	65,2	-0,4%	11,22	0,8%	34,29	-0,1%	5794	-0,8%	1081,5	0,5%	939.780	-1,1%	70	-0,5%	142,27	-4,5%	35.210	-1,4%
t=38	0,2%	133,65	1,9%	83,808	0,4%	65,34	0,2%	11,04	-1,6%	34,2	-0,3%	5860	1,1%	1079	-0,2%	965.590	2,7%	71,21	1,7%	146,28	2,8%	34.190	-2,9%
t=39	-0,6%	133,35	-0,2%	81,1	-3,2%	63,37	-3,0%	11,19	1,4%	34,93	2,1%	5893	0,6%	1118	3,6%	908.730	-5,9%	68,93	-3,2%	144,02	-1,5%	33.740	-1,3%
t=40	0,1%	138,75	4,0%	81,42	0,4%	63,48	0,2%	11,26	0,6%	34,94	0,0%	6157	4,5%	1146,5	2,5%	918.590	1,1%	69,46	0,8%	144,18	0,1%	33.880	0,4%
t=41	1,4%	145,45	4,8%	83,889	3,0%	64,87	2,2%	11,68	3,7%	36,35	4,0%	6258	1,6%	1150,5	0,3%	955.990	4,1%	72,78	4,8%	149,04	3,4%	34.680	2,4%
t=42	0,5%	137,75	-5,3%	80,589	-3,9%	62,58	-3,5%	11,53	-1,3%	36,07	-0,8%	6126	-2,1%	1136	-1,3%	972.920	1,8%	73,79	1,4%	150,27	0,8%	34.730	0,1%
t=43	0,0%	131,8	-4,3%	78,043	-3,2%	59,85	-4,4%	11,17	-3,1%	35,77	-0,8%	6228	1,7%	1107,5	-2,5%	941.530	-3,2%	73,04	-1,0%	149,5	-0,5%	35.310	1,7%
t=44	0,2%	130	-1,4%	81,148	4,0%	60,53	1,1%	10,95	-2,0%	35,27	-1,4%	6216	-0,2%	1085,5	-2,0%	927.960	-1,4%	72,68	-0,5%	156,39	4,6%	36.300	2,8%
t=45	-1,4%	127,5	-1,9%	79,752	-1,7%	59,8	-1,2%	10,77	-1,6%	34,93	-1,0%	6275	0,9%	1088	0,2%	914.390	-1,5%	72,5	-0,2%	157,48	0,7%	35.870	-1,2%
t=46	-0,6%	128	0,4%	79,737	0,0%	60,31	0,9%	10,56	-1,9%	34,83	-0,3%	6125	-2,4%	1098,5	1,0%	910.670	-0,4%	72,49	0,0%	157,5	0,0%	35.010	-2,4%
t=47	0,7%	127,35	-0,5%	79,487	-0,3%	62,17	3,1%	10,82	2,5%	35,6	2,2%	6158	0,5%	1082,5	-1,5%	915.890	0,6%	72,82	0,5%	159,86	1,5%	34.670	-1,0%
t=48	1,4%	126,5	-0,7%	78,999	-0,6%	61,8	-0,6%	11,35	4,9%	37,36	4,9%	6182	0,4%	1096	1,2%	937.340	2,3%	73,94	1,5%	164,05	2,6%	35.090	1,2%
t=49	-0,6%	132,35	4,6%	82,698	4,7%	64,83	4,9%	11,36	0,1%	37	-1,0%	6220	0,6%	1089,5	-0,6%	926.500	-1,2%	73,98	0,1%	158,63	-3,3%	35.190	0,3%
t=50	1,6%	136,75	3,3%	84,619	2,3%	66,25	2,2%	11,62	2,3%	38,88	5,1%	6480	4,2%	1129	3,6%	920.290	-0,7%	75,31	1,8%	159,88	0,8%	37.000	5,1%
t=51	0,1%	137,6	0,6%	85,301	0,8%	66,6	0,5%	11,84	1,9%	39,42	1,4%	6733	3,9%	1152	2,0%	928.530	0,9%	74,41	-1,2%	151,89	-5,0%	37.180	0,5%
t=52	0,7%	138	0,3%	85,45	0,2%	67,47	1,3%	11,97	1,1%	40,38	2,4%	6710	-0,3%	1114,5	-3,3%	959.110	3,3%	74,49	0,1%	154,12	1,5%	38.080	2,4%
t=53	1,2%	142,8	3,5%	89,271	4,5%	68,7	1,8%	12,31	2,8%	44,93	11,3%	6889	2,7%	1091,5	-2,1%	978.890	2,1%	76	2,0%	155,3	0,8%	39.630	4,1%
t=54	0,2%	144,15	0,9%	87,487	-2,0%	67,91	-1,1%	12,05	-2,1%	45,88	2,1%	6897	0,1%	1085	-0,6%	989.680	1,1%	77,49	2,0%	156,99	1,1%	39.670	0,1%
t=55	0,9%	141,55	-1,8%	86,385	-1,3%	68,36	0,7%	12,1	0,4%	45,61	-0,6%	6999	1,5%	1079	-0,6%	988.200	-0,1%	78,81	1,7%	156,25	-0,5%	40.430	1,9%
t=56	0,2%	152	7,4%	87,003	0,7%	71,11	4,0%	12,06	-0,3%	44,64	-2,1%	7073	1,1%	1101,5	2,1%	1.019.270	3,1%	83,81	6,3%	163,05	4,4%	44.400	9,8%
t=57	0,3%	162,95	7,2%	89,499	2,9%	73,25	3,0%	12,36	2,5%	42,34	-5,2%	7155	1,2%	1111,5	0,9%	1.032.480	1,3%	84,14	0,4%	172,5	5,8%	46.340	4,4%
t=58	-0,2%	156,5	-4,0%	86,211	-3,7%	70,57	-3,7%	12,01	-2,8%	42,66	0,8%	7108	-0,7%	1093	-1,7%	1.028.070	-0,4%	83,87	-0,3%	174,67	1,3%	45.580	-1,6%
t=59	-0,1%	158,75	1,4%	84,93	-1,5%	68,97	-2,3%	12,01	0,0%	43,88	2,9%	6917	-2,7%	1070	-2,1%	1.019.090	-0,9%	82,4	-1,8%	170,15	-2,6%	44.630	-2,1%
t=60	0,9%	169,45	6,7%	86,38	1,7%	70	1,5%	12,1	0,7%	44,46	1,3%	7023	1,5%	1077,5	0,7%	1.040.610	2,1%	83,26	1,0%	174,97	2,8%	44.750	0,3%
t=61	1,5%	173,35	2,3%	83,57	-3,3%	68,29	-2,4%	12,58	4,0%	42,79	-3,8%	7051	0,4%	1089	1,1%	1.010.170	-2,9%	84,26	1,2%	171,05	-2,2%	44.680	-0,2%
t=62	0,4%	172,15	-0,7%	85,48	2,3%	70,3	2,9%	12,61	0,2%	42,02	-1,8%	7017	-0,5%	1085,5	-0,3%	1.037.050	2,7%	84,16	-0,1%	169,37	-1,0%	43.350	-3,0%
t=63	0,9%	169,2	-1,7%	85,899	0,5%	71,01	1,0%	12,58	-0,2%	40,95	-2,5%	6966	-0,7%	1096,5	1,0%	1.064.190	2,6%	86,85	3,2%	173,97	2,7%	44.560	2,8%
t=64	0,3%	169	-0,1%	87,951	2,4%	71,31	0,4%	12,58	0,0%	42,02	2,6%	7282	4,5%	1120,5	2,2%	1.060.120	-0,4%	85,51	-1,5%	175,01	0,6%	46.700	4,8%
t=65	-0,4%	166,45	-1,5%	87,06	-1,0%	70,8	-0,7%	12,49	-0,7%	40,99	-2,5%	7219,09	-0,9%	1123,5	0,3%	1.046.400	-1,3%	85,54	0,0%	169,23	-3,3%	46.160	-1,2%
t=66	2,6%	179,2	7,7%	88,37	1,5%	72,98	3,1%	13,2	5,7%	44,01	7,4%	7552	4,6%	1149	2,3%	1.102.230	5,3%	88,19	3,1%	175	3,4%	44.740	-3,1%
t=67	1,6%	179,82	0,3%	89,94	1,8%	74,18	1,6%	13,23	0,2%	44,07	0,1%	7578	0,3%	1148,5	0,0%	1.122.260	1,8%	89,6	1,6%	177,09	1,2%	43.240	-3,4%
t=68	0,9%	183,72	2,2%	94,54	5,1%	75,01	1,1%	12	-9,3%	43,15	-2,1%	7739	2,1%	1154	0,5%	1.137.510	1,4%	90	0,4%	178,46	0,8%	44.820	3,7%
t=69	2,2%	181,9	-1,0%	93,84	-0,7%	74,81	-0,3%	11,65	-2,9%	43,49	0,8%	7608	-1,7%	1182	2,4%	1.175.840	3,4%	94,06	4,5%	171,51	-3,9%	50.080	11,7%
t=70	-3,9%	172,06	-5,4%	90,31	-3,8%	71,17	-4,9%	10,71	-8,1%	41	-5,7%	7626	0,2%	1173	-0,8%	1.111.900	-5,4%	91,78	-2,4%	160,5	-6,4%	46.150	-7,8%
t=71	-5,2%	163,2	-5,1%	85,86	-4,9%	70,13	-1,5%	10,53	-1,7%	41,46	1,1%	7465	-2,1%	1127,5	-3,9%	1.037.780	-6,7%	88,18	-3,9%	156,41	-2,5%	43.950	-4,8%
t=72	4,3%	167,28	2,5%	88,09	2,6%	72,5	3,4%	10,61	0,8%	41,09	-0,9%	7208	-3,4%	1115,5	-1,1%	1.094.800	5,5%	92	4,3%	172,43	10,2%	45.560	3,7%
t=73	0,6%	162,6	-2,8%	87,03	-1,2%	70,41	-2,9%	10,7	0,8%	40,91	-0,4%	7283	1,0%	1119,5	0,4%	1.126.790	2,9%	94,06	2,2%	175,5	1,8%	47.730	4,8%
t=74	-2,0%	153,76	-5,4%	84,39	-3,0%	67,35	-4,3%	10,4	-2,8%	37,43	-8,5%	6916	-5,0%	1105	-1,3%	1.078.920	-4,2%	93,05	-1,1%	176,21	0,4%	48.980	2,6%
t=75	3,5%	156,88	2,0%	85,4	1,2%	67,92	0,8%	10,73	3,2%	37,84	1,1%	6791	-1,8%	1112	0,6%	1.160.040	7,5%	96,54	3,8%	179,98	2,1%	52.190	6,6%
t=76	-1,2%	162,12	3,3%	86,21	0,9%	69,17	1,8%	11,15	3,9%	37,94	0,3%	6884	1,4%	1123,5	1,0%	1.135.730	-2,1%	94,6	-2,0%	178,02	-1,1%	51.170	-2,0%
t=77	-6,0%	153,68	-5,2%	84,05	-2,5%	65,77	-4,9%	10,56	-5,3%	35,17	-7,3%	6603	-4,1%	1105	-1,6%	1.021.570	-10,1%	87,18	-7,8%	164,94	-7,3%	49.360	-3,5%
t=78	2,0%	161,38	5,0%	88	4,7%	68,97	4,9%	11,08	4,9%	36,34	3,3%	6825	3,4%	1104	-0,1%	1.031.790	1,0%	91,27	4,7%	167,78	1,7%	52.080	5,5%
t=79	-1,4%	165	2,2%	89,25	1,4%	65,33	-5,3%	11,18	0,9%	37,68	3,7%	6728	-1,4%	1115,5	1,0%	1.007.040	-2,4%	90,23	-1,1%	168,38	0,4%	48.790	-6,3%
t=80	2,0%	177,28	7,4%	91,46	2,5%	65,65	0,5%	11,28	0,9%	38,73	2,8%	6910	2,7%	1125	0,9%	1.029.270	2,2%	93,08	3,2%	174,73	3,8%	51.860	6,3%
t=81	0,5%	171,1	-3,5%	91,15	-0,3%	65,12	-0,8%	10,82	-4,1%	37,61	-2,9%	6957	0,7%	1135	0,9%	1.072.960	4,2%	95	2,1%	165,72	-5,2%	51.530	-0,6%
t=82	0,0%	172,72	0,9%	91,16	0,0%	65,64	0,8%	11,49	6,2%	37,65	0,1%	7181	3,2%	1151,5	1,5%	1.030.050	-4,0%	95,82	0,9%	162,32	-2,1%	52.730	2,3%
t=83	-0,2%	172,72	0,0%	91,94	0,9%	66,48	1,3%	11,36	-1,1%	36,71	-2,5%	7165	-0,2%	1127,5	-2,1%	1.048.210	1,8%	95,16	-0,7%	183,83	13,3%	52.780	0,1%
t=84	2,4%	172,3	-0,2%	92,11	0,2%	67,05	0,9%	11,19	-1,5%	36,89	0,5%	7543	5,3%	1111	-1,5%	1.098.260	4,8%	97,7	2,7%	188,59	2,6%	54.670	3,6%
t=85	-0,5%	173,1	0,5%	88,95	-3,4%	67,4	0,5%	11,33	1,3%	37,79	2,4%	7571	0,4%	1146	3,2%	1.066.360	-2,9%	96,36	-1,4%	186,31	-1,2%	53.500	-2,1%
t=86	0,3%	170,14	-1,7%	87,32	-1,8%	65,07	-3,5%	11,51	1,6%	38,3	1,3%	7115	-6,0%	1116	-2,6%	1.075.660	0,9%	98,36	2,1%	188,58	1,2%	55.440	3,6%
t=87	0,5%	162,14	-4,7%	85,89	-1,6%	62,03	-4,7%	11,71	1,7%	43,2	12,8%	7122	0,1%	1077	-3,5%	1.119.500	4,1%	100,79	2,5%	190,24	0,9%	57.080	3,0%
t=88	1,6%	159,4	-1,7%	85,76	-0,2%	61,96	-0,1%	12,1	3,3%	44,25	2,4%	7480	5,0%	1094	1,6%	1.120.870	0,1%	101,63	0,8%	191,7	0,8%	55.050	-3,6%
t=89	0,0%	161,02	1,0%	85,57	-0,2%	62,32	0,6%	11,88	-1,8%	43,91	-0,8%	7562	1,1%	1091	-0,3%	1.152.260	2,8%	100,13	-1,5%	188,84	-1,5%	55.110	0,1%
t=90	-0,9%	149,38	-7,2%	80,43	-6,0%	57,66	-7,5%	11,65	-1,9%	41,25	-6,1%	7199	-4,8%	1078,5	-1,1%	1.155.480	0,3%	100,41	0,3%	184,92	-2,1%	52.500	-4,7%
t=91	-1,3%	142,22	-4,8%	77,82	-3,2%	55,13	-4,4%	11,07	-5,0%	39,4	-4,5%	7170	-0,4%	1078	0,0%	1.115.650	-3,4%	98,61	-1,8%	185,11	0,1%	49.710	-5,3%
t=92	1,5%	147,74	3,9%	80,32	3,2%	58,04	5,3%	11,06	-0,1%	39,16	-0,6%	7162	-0,1%	1051,5	-2,5%	1.140.170	2,2%	101,16	2,6%	187,97	1,5%	51.370	3,3%
t=93	1,5%	144	-2,5%	80,2	-0,1%	57,25	-1,4%	10,98	-0,7%	39,36	0,5%	7278	1,6%	1028,5	-2,2%	1.188.820	4,3%	105,43	4,2%	191,33	1,8%	52.220	1,7%
t=94	0,0%	144,66	0,5%	79,07	-1,4%	57,26	0,0%	10,56	-3,8%	39,4	0,1%	7440	2,2%	1034,5	0,6%	1.184.910	-0,3%	106,27	0,8%	191,44	0,1%	51.910	-0,6%
t=95	0,6%	151,12	4,5%	82,79	4,7%	59,29	3,5%	9,93	-6,0%	37,53	-4,7%	7456	0,2%	1036,5	0,2%	1.238.500	4,5%	107,68	1,3%	190,98	-0,2%	47.680	-8,1%
t=96	0,8%	145,34	-3,8%	82,46	-0,4%	58,16	-1,9%	10,04	1,1%	37,73	0,5%	7220	-3,2%	1043	0,6%	1.223.710	-1,2%	108,04	0,3%	207,99	8,9%	49.630	4,1%
t=97	-0,2%	144,38	-0,7%	83,26	1,0%	57,2	-1,7%	9,74	-3,0%	36,59	-3,0%	6951	-3,7%	1042	-0,1%	1.237.610	1,1%	109	0,9%	207,53	-0,2%	48.850	-1,6%
t=98	0,6%	138,74	-3,9%	81,39	-2,2%	54,92	-4,0%	9,55	-2,0%	36,38	-0,6%	6803	-2,1%	1038	-0,4%	1.200.960	-3,0%	107,58	-1,3%	217,58	4,8%	47.100	-3,6%
t=99	0,9%	138	-0,5%	81,41	0,0%	54,75	-0,3%	9,68	1,4%	35,95	-1,2%	6830	0,4%	1031,5	-0,6%	1.220.650	1,6%	108,4	0,8%	216,16	-0,7%	47.660	1,2%
t=100	0,9%	140,84	2,1%	83,33	2,4%	55,7	1,7%	9,48	-2,1%	36,05	0,3%	6930	1,5%	1040	0,8%	1.218.190	-0,2%	112,33	3,6%	227,63	5,3%	48.430	1,6%
t=101	-1,0%	136,08	-3,4%	80,94	-2,9%	54,48	-2,2%	9,27	-2,2%	33,91	-5,9%	6596	-4,8%	1021	-1,8%	1.164.830	-4,4%	108,21	-3,7%	221,3	-2,8%	46.450	-4,1%
t=102	1,2%	144	5,8%	82,61	2,1%	55,54	1,9%	9,45	1,9%	34,63	2,1%	6848	3,8%	1060	3,8%	1.172.530	0,7%	113,37	4,8%	223,84	1,1%	45.540	-2,0%
t=103	0,8%	154,38	7,2%	85,65	3,7%	57,61	3,7%	9,85	4,2%	35,32	2,0%	7000	2,2%	1105,5	4,3%	1.166.090	-0,5%	114,26	0,8%	217,66	-2,8%	46.660	2,5%
t=104	-0,5%	151,6	-1,8%	77,6	-9,4%	54,35	-5,7%	9,25	-6,1%	33,67	-4,7%	7095	1,4%	1063,5	-3,8%	1.193.470	2,3%	114,37	0,1%	225,74	3,7%	47.290	1,4%
As of September 30, 2018		Volkswagen		BMW		Daimler		Ford		General Motors		Toyota		Nissan		Google		Microsoft		Apple		Intel	
debt (in millions)		175.569		98.084		141.126		153.431		103.520		########		8.090.367		3.986		87.928		114.483		27.874	
cash and short term inv.		30.005		14.067		21.064		23.605		19.851		5.868.949		1.206.153		3.986		87.928		66.301		13.186	
net debt		145.564		84.017		120.062		129.826		83.669		########		6.884.214		0		0		48.182		14.688	
market cap= equity (in millions)		72.781		48.485		54.936		35.761		51.643		########		4.024.711		749.418		785.431		956.625		208.529	
Debt rating		BBB+		A+		A		BBB		BBB		AA-		A-		AA+		AAA		AA+		A+	
effective tax rate based on average of last 4 full financial years (2014-2017)		22,6%		27,7%		28,5%		23,3%		41,1%		26,7%		25,6%		27,7%		22,4%		25,7%		29,7%	
Cov(asset; market)		0,000245		0,000227		0,00021		0,000241		0,000247		0,000156		6,36E-05		0,000318		0,000242		0,000209		0,000264	
Var (market)		0,000217		0,000217		0,00022		0,00022		0,00022		0,00022		0,00022		0,00022		0,00022		0,00022		0,00022	
Equity beta		**1,13**		**1,04**		**0,966**		**1,110**		**1,137**		**0,715**		**0,292**		**1,463**		**1,114**		**0,961**		**1,212**	
Debt beta		**0,07**		**0,017**		**0,018**		**0,100**		**0,100**		**0,015**		**0,049**		**0,012**		**0,010**		**0,012**		**0,017**	
Asset beta		**0,424**		**0,392**		**0,316**		**0,318**		**0,496**		**0,404**		**0,139**		**1,463**		**1,114**		**0,916**		**1,133**	

Appendix 4

Annualized volatility of Tesla's stock return

1 year of data

Trading days	Tesla stock price	daily returns (Xt)	(Xt - X)^2
1	341,10	n/a	n/a
2	341,53	0,13%	0,00%
3	348,14	1,94%	0,04%
4	355,01	1,97%	0,04%
5	355,33	0,09%	0,00%
6	356,88	0,44%	0,00%
7	342,94	-3,91%	0,15%
8	355,59	3,69%	0,14%
9	354,60	-0,28%	0,00%
10	355,68	0,30%	0,00%
11	355,57	-0,03%	0,00%
12	350,60	-1,40%	0,02%
13	355,75	1,47%	0,02%
14	359,65	1,10%	0,01%
15	351,81	-2,18%	0,05%
16	345,10	-1,91%	0,03%
17	337,02	-2,34%	0,05%
18	337,34	0,09%	0,00%
19	325,84	-3,41%	0,11%
20	326,17	0,10%	0,00%
21	320,87	-1,62%	0,02%
22	320,08	-0,25%	0,00%
23	331,53	3,58%	0,13%
24	321,08	-3,15%	0,10%
25	299,26	-6,80%	0,45%
26	306,09	2,28%	0,05%
27	302,78	-1,08%	0,01%
28	306,05	1,08%	0,01%
29	304,39	-0,54%	0,00%
30	302,99	-0,46%	0,00%
31	302,99	0,00%	0,00%
32	315,40	4,10%	0,17%
33	308,70	-2,12%	0,04%
34	311,30	0,84%	0,01%
35	312,50	0,39%	0,00%
36	315,05	0,82%	0,01%
37	308,74	-2,00%	0,04%
38	317,81	2,94%	0,09%
39	312,60	-1,64%	0,03%
40	315,55	0,94%	0,01%
41	316,81	0,40%	0,00%
42	317,55	0,23%	0,00%
43	307,54	-3,15%	0,10%

44	308,85	0,43%	0,00%
45	306,53	-0,75%	0,00%
46	305,20	-0,43%	0,00%
47	303,70	-0,49%	0,00%
48	313,26	3,15%	0,10%
49	311,24	-0,64%	0,00%
50	315,13	1,25%	0,02%
51	328,91	4,37%	0,20%
52	341,03	3,68%	0,14%
53	339,03	-0,59%	0,00%
54	337,89	-0,34%	0,00%
55	343,45	1,65%	0,03%
56	338,87	-1,33%	0,02%
57	331,10	-2,29%	0,05%
58	328,98	-0,64%	0,00%
59	331,66	0,81%	0,01%
60	325,20	-1,95%	0,04%
61	317,29	-2,43%	0,06%
62	311,64	-1,78%	0,03%
63	315,36	1,19%	0,02%
64	311,35	-1,27%	0,01%
65	320,53	2,95%	0,09%
66	317,25	-1,02%	0,01%
67	314,62	-0,83%	0,01%
68	316,58	0,62%	0,00%
69	336,41	6,26%	0,40%
70	333,69	-0,81%	0,01%
71	334,80	0,33%	0,00%
72	337,95	0,94%	0,01%
73	336,22	-0,51%	0,00%
74	340,06	1,14%	0,01%
75	347,16	2,09%	0,05%
76	344,57	-0,75%	0,00%
77	350,02	1,58%	0,03%
78	351,56	0,44%	0,00%
79	352,79	0,35%	0,00%
80	345,89	-1,96%	0,04%
81	337,64	-2,39%	0,05%
82	342,85	1,54%	0,03%
83	349,53	1,95%	0,04%
84	345,82	-1,06%	0,01%
85	354,31	2,46%	0,06%
86	349,25	-1,43%	0,02%
87	343,75	-1,57%	0,02%
88	333,13	-3,09%	0,09%
89	333,97	0,25%	0,00%
90	345,00	3,30%	0,11%
91	315,23	-8,63%	0,74%
92	310,42	-1,53%	0,02%
93	315,73	1,71%	0,03%

94	323,66	2,51%	0,07%
95	322,31	-0,42%	0,00%
96	334,07	3,65%	0,14%
97	335,49	0,43%	0,00%
98	334,77	-0,21%	0,00%
99	333,30	-0,44%	0,00%
100	346,17	3,86%	0,15%
101	352,05	1,70%	0,03%
102	357,42	1,53%	0,02%
103	350,99	-1,80%	0,03%
104	343,06	-2,26%	0,05%
105	330,93	-3,54%	0,12%
106	335,12	1,27%	0,02%
107	333,35	-0,53%	0,00%
108	328,20	-1,54%	0,02%
109	332,30	1,25%	0,02%
110	329,10	-0,96%	0,01%
111	327,17	-0,59%	0,00%
112	345,51	5,61%	0,32%
113	341,84	-1,06%	0,01%
114	326,63	-4,45%	0,19%
115	325,60	-0,32%	0,00%
116	321,35	-1,31%	0,02%
117	313,56	-2,42%	0,06%
118	310,55	-0,96%	0,01%
119	316,53	1,93%	0,04%
120	309,10	-2,35%	0,05%
121	301,54	-2,45%	0,06%
122	304,18	0,88%	0,01%
123	279,18	-8,22%	0,67%
124	257,78	-7,67%	0,58%
125	266,13	3,24%	0,11%
126	252,48	-5,13%	0,26%
127	267,53	5,96%	0,36%
128	286,94	7,26%	0,53%
129	305,72	6,54%	0,44%
130	299,30	-2,10%	0,04%
131	289,66	-3,22%	0,10%
132	304,70	5,19%	0,28%
133	300,93	-1,24%	0,01%
134	294,08	-2,28%	0,05%
135	300,34	2,13%	0,05%
136	291,21	-3,04%	0,09%
137	287,69	-1,21%	0,01%
138	293,35	1,97%	0,04%
139	300,08	2,29%	0,06%
140	290,24	-3,28%	0,10%
141	283,37	-2,37%	0,05%
142	283,46	0,03%	0,00%
143	280,69	-0,98%	0,01%

144	285,48	1,71%	0,03%
145	294,08	3,01%	0,09%
146	293,90	-0,06%	0,00%
147	299,92	2,05%	0,04%
148	301,15	0,41%	0,00%
149	284,45	-5,55%	0,30%
150	294,09	3,39%	0,12%
151	302,77	2,95%	0,09%
152	301,97	-0,26%	0,00%
153	306,85	1,62%	0,03%
154	305,02	-0,60%	0,00%
155	301,06	-1,30%	0,02%
156	291,97	-3,02%	0,09%
157	284,18	-2,67%	0,07%
158	286,48	0,81%	0,01%
159	284,54	-0,68%	0,00%
160	276,82	-2,71%	0,07%
161	284,49	2,77%	0,08%
162	275,01	-3,33%	0,11%
163	279,07	1,48%	0,02%
164	277,85	-0,44%	0,00%
165	278,85	0,36%	0,00%
166	283,76	1,76%	0,03%
167	291,72	2,81%	0,08%
168	284,73	-2,40%	0,05%
169	291,82	2,49%	0,06%
170	296,74	1,69%	0,03%
171	291,13	-1,89%	0,03%
172	319,50	9,74%	0,96%
173	316,09	-1,07%	0,01%
174	317,66	0,50%	0,00%
175	332,10	4,55%	0,21%
176	342,77	3,21%	0,11%
177	344,78	0,59%	0,00%
178	357,72	3,75%	0,14%
179	358,17	0,13%	0,00%
180	370,83	3,53%	0,13%
181	352,55	-4,93%	0,24%
182	362,22	2,74%	0,08%
183	347,51	-4,06%	0,16%
184	333,63	-3,99%	0,16%
185	333,01	-0,19%	0,00%
186	342,00	2,70%	0,08%
187	344,50	0,73%	0,01%
188	349,93	1,58%	0,03%
189	342,95	-1,99%	0,04%
190	335,07	-2,30%	0,05%
191	310,86	-7,23%	0,51%
192	309,16	-0,55%	0,00%
193	308,90	-0,08%	0,00%

194	318,51	3,11%	0,10%
195	322,47	1,24%	0,02%
196	318,96	-1,09%	0,01%
197	316,71	-0,71%	0,00%
198	318,87	0,68%	0,01%
199	310,10	-2,75%	0,07%
200	322,69	4,06%	0,17%
201	323,85	0,36%	0,00%
202	320,23	-1,12%	0,01%
203	313,58	-2,08%	0,04%
204	303,20	-3,31%	0,11%
205	297,43	-1,90%	0,03%
206	308,74	3,80%	0,15%
207	306,65	-0,68%	0,00%
208	297,18	-3,09%	0,09%
209	290,17	-2,36%	0,05%
210	298,14	2,75%	0,08%
211	300,84	0,91%	0,01%
212	349,54	16,19%	2,64%
213	348,17	-0,39%	0,00%
214	341,99	-1,77%	0,03%
215	379,57	10,99%	1,22%
216	370,34	-2,43%	0,06%
217	352,45	-4,83%	0,23%
218	355,49	0,86%	0,01%
219	356,41	0,26%	0,00%
220	347,64	-2,46%	0,06%
221	338,69	-2,57%	0,06%
222	335,45	-0,96%	0,01%
223	305,50	-8,93%	0,79%
224	308,44	0,96%	0,01%
225	321,90	4,36%	0,20%
226	321,64	-0,08%	0,00%
227	320,10	-0,48%	0,00%
228	322,82	0,85%	0,01%
229	319,27	-1,10%	0,01%
230	311,86	-2,32%	0,05%
231	305,01	-2,20%	0,05%
232	303,15	-0,61%	0,00%
233	301,66	-0,49%	0,00%
234	288,95	-4,21%	0,17%
235	280,74	-2,84%	0,08%
236	280,95	0,07%	0,00%
237	263,24	-6,30%	0,39%
238	285,50	8,46%	0,72%
239	279,44	-2,12%	0,04%
240	290,54	3,97%	0,16%
241	289,46	-0,37%	0,00%
242	295,20	1,98%	0,04%
243	294,84	-0,12%	0,00%

244	284,96	-3,35%	0,11%
245	299,02	4,93%	0,25%
246	298,33	-0,23%	0,00%
247	299,10	0,26%	0,00%
248	299,68	0,19%	0,00%
249	300,99	0,44%	0,00%
250	309,58	2,85%	0,08%
251	307,52	-0,67%	0,00%
252	264,77	-13,90%	1,92%

Sample mean (X)
-0,05%

Sum of (Xt - X)^2
24,6258%

t-1
251

Variance
0,0981%

Standard Deviation
3,13%

Annualized Std.
49,72%

Appendix 5

Valuation of Tesla's stock options

Current stock price	287,74
Adjusted stock price (*S 0)*	270,59
Strike price on the option (K)	105,56
Expiration of the option	4,7
Adjustment for early exercise	20,00%
Adjusted expiration (T)	3,76
Standard deviation in stock return	48,51%
Variance	0,235
Treasury bond rate	2,90%
Number of options outstanding (31.12.2017)	10.881.025
Number of shares outstanding (30.9.2018)	171.732.775
d1 =	1,586914086
N (d1) =	0,943733948
d2 =	0,646191393
N (d2) =	0,740922293
Option value	185,23
Total value of options outstanding	2.015.527.431

Appendix 6

S&P Capital IQ

Income Statement

For the Fiscal Period Ending	12 months Dec-31-2010	12 months Dec-31-2011	12 months Dec-31-2012	12 months Dec-31-2013	12 months Dec-31-2014	12 months Dec-31-2015	Reclassified 12 months Dec-31-2016	12 months Dec-31-2017	31.12.2018 E
Currency	*USD*	*USD*	*USD*	*USD*	*USD*	*USD*	*USD*	*USD*	
Revenue	116,7	204,2	413,3	2.013,5	3.198,4	4.046,0	7.000,1	11.758,8	18.980,5
Other Revenue	-	-	-	-	-	-	-	-	
Total Revenue	**116,7**	**204,2**	**413,3**	**2.013,5**	**3.198,4**	**4.046,0**	**7.000,1**	**11.758,8**	**18.980,5**
Cost Of Goods Sold	86,0	142,6	383,2	1.557,2	2.316,7	3.122,5	5.400,9	9.536,3	15.515,0
Gross Profit	**30,7**	**61,6**	**30,1**	**456,3**	**881,7**	**923,5**	**1.599,3**	**2.222,5**	**3.465,5**
Selling General & Admin Exp.	84,6	104,1	150,4	285,6	603,7	922,2	1.410,5	2.450,7	2.889,4
R & D Exp.	93,0	209,0	274,0	232,0	464,7	717,9	834,4	1.378,1	1.472,1
Depreciation & Amort.	-	-	-	-	-	-	-	-	
Other Operating Expense/(Income)	-	-	-	-	-	-	-	-	
Other Operating Exp., Total	**177,6**	**313,1**	**424,4**	**517,5**	**1.068,4**	**1.640,1**	**2.244,9**	**3.828,8**	**4.361,5**
Operating Income	**(146,8)**	**(251,5)**	**(394,3)**	**(61,3)**	**(186,7)**	**(716,6)**	**(645,6)**	**(1.606,3)**	**(896,1)**
Interest Expense	(1,0)	0	(0,3)	(32,9)	(100,9)	(118,9)	(191,8)	(477,1)	(629,1)
Interest and Invest. Income	0,3	0,3	0,3	0,2	1,1	1,5	8,5	19,7	22,9
Net Interest Exp.	**(0,7)**	**0,2**	**0,0**	**(32,7)**	**(99,8)**	**(117,3)**	**(183,3)**	**(457,5)**	**(606,1)**
Currency Exchange Gains (Loss)	-	-	-	11,9	2,0	(45,6)	26,1	(52,3)	(63,6)
Other Non-Operating Inc. (Exp.)	(6,6)	(2,6)	(1,8)	10,7	(0,2)	3,9	(10,6)	(9,4)	89,6
EBT Excl. Unusual Items	**(154,2)**	**(253,9)**	**(396,1)**	**(71,4)**	**(284,6)**	**(875,6)**	**(813,4)**	**(2.125,5)**	**(1.476,1)**
Merger & Related Restruct. Charges	-	-	-	-	-	-	(21,7)	-	(155,1)
Impairment of Goodwill	-	-	-	-	-	-	88,7	(57,7)	
Other Unusual Items	-	-	-	-	-	-	-	(25,8)	(17,7)
EBT Incl. Unusual Items	**(154,2)**	**(253,9)**	**(396,1)**	**(71,4)**	**(284,6)**	**(875,6)**	**(746,3)**	**(2.209,0)**	**(1.648,9)**
Income Tax Expense	0,2	0,5	0,1	2,6	9,4	13,0	26,7	31,5	47,9
Earnings from Cont. Ops.	**(154,3)**	**(254,4)**	**(396,2)**	**(74,0)**	**(294,0)**	**(888,7)**	**(773,0)**	**(2.240,6)**	**(1.696,8)**
Historical Analysis		-	-	-	-	-	-	-	
Extraord. Item & Account. Change	-	-	-	-	-	-	-	-	
Net Income to Company	**(154,3)**	**(254,4)**	**(396,2)**	**(74,0)**	**(294,0)**	**(888,7)**	**(773,0)**	**(2.240,6)**	**(1.696,8)**
Minority Int. in Earnings	-	-	-	-	-	-	98,1	279,2	209,4
Net Income	**(154,3)**	**(254,4)**	**(396,2)**	**(74,0)**	**(294,0)**	**(888,7)**	**(674,9)**	**(1.961,4)**	**(1.487,4)**

Income Statement

For the Fiscal Period Ending	3 months Q1 Mar-31-2018	3 months Q2 Jun-30-2018	3 months Q3 Sep-30-2018
Currency	*USD*	*USD*	*USD*
Revenue	3.408,8	4.002,2	6.824,4
Other Revenue	-	-	-
Total Revenue	**3.408,8**	**4.002,2**	**6.824,4**
Cost Of Goods Sold	2.952,2	3.383,3	5.300,7
Gross Profit	**456,5**	**618,9**	**1.523,7**
Selling General & Admin Exp.	686,4	750,8	729,9
R & D Exp.	367,1	386,1	350,8
Depreciation & Amort.	-	-	-
Other Operating Expense/(Income)	-	-	-
Other Operating Exp., Total	**1.053,5**	**1.136,9**	**1.080,7**
Operating Income	**(597,0)**	**(518,0)**	**442,9**
Interest Expense	(139,9)	(162,0)	(169,9)
Interest and Invest. Income	5,2	5,1	6,9
Net Interest Exp.	**(134,7)**	**(156,9)**	**(163,0)**
Currency Exchange Gains (Loss)	(47,7)	0	0
Other Non-Operating Inc. (Exp.)	0,4	49,3	17,5
EBT Excl. Unusual Items	**(779,0)**	**(625,6)**	**297,5**
Restructuring Charges	0	(90,1)	(26,2)
Impairment of Goodwill	0	0	0
Asset Writedown	0	(13,3)	0
Other Unusual Items	0	0	0
EBT Incl. Unusual Items	**(779,0)**	**(729,0)**	**271,3**
Income Tax Expense	5,6	13,7	16,6
Earnings from Cont. Ops.	**(784,6)**	**(742,7)**	**254,7**
Earnings of Discontinued Ops.	-	-	-
Extraord. Item & Account. Change	-	-	-
Net Income to Company	**(784,6)**	**(742,7)**	**254,7**
Minority Int. in Earnings	75,1	25,2	56,8
Net Income	**(709,6)**	**(717,5)**	**311,5**

S&P Capital IQ

Balance Sheet

Balance Sheet as of:	Dez-31-2010	Dez-31-2011	Dez-31-2012	Dez-31-2013	Restated Dec-31-2014	Restated Dec-31-2015	Dez-31-2016	Dez-31-2017	31.12.2018 E
Currency	*USD*	*USD*	*USD*	*USD*	*USD*	*USD*	*USD*	*USD*	
ASSETS									
Cash And Equivalents	99,6	255,3	201,9	845,9	1.905,7	1.196,9	3.393,2	3.367,9	4.378,3
Short Term Investments	-	25,1	-	-	-	-	-	-	0
Total Cash & ST Investments	**99,6**	**280,3**	**201,9**	**845,9**	**1.905,7**	**1.196,9**	**3.393,2**	**3.367,9**	**4.378,3**
Accounts Receivable	6,7	9,5	26,8	49,1	226,6	169,0	499,1	515,4	670,0
Total Receivables	**6,7**	**9,5**	**26,8**	**49,1**	**226,6**	**169,0**	**499,1**	**515,4**	**670,0**
Inventory	45,2	50,1	268,5	340,4	953,7	1.277,8	2.067,5	2.263,5	2.942,6
Prepaid Exp.	10,8	9,4	8,4	27,6	76,1	108,4	194,5	268,4	348,9
Restricted Cash	73,6	23,5	19,1	3,0	17,9	22,6	105,5	155,3	201,9
Other Current Assets	-	-	-	-	-	7,3	-	-	
Total Current Assets	**235,9**	**372,8**	**524,8**	**1.265,9**	**3.180,1**	**2.782,0**	**6.259,8**	**6.570,5**	**8.541,7**
Gross Property, Plant & Equipment	145,0	344,4	623,1	1.280,6	2.971,7	5.982,4	16.454,1	23.168,8	30.119,5
Accumulated Depreciation	(22,4)	(34,2)	(60,8)	(159,6)	(375,7)	(787,6)	(1.417,1)	(2.677,2)	(3.480,4)
Net Property, Plant & Equipment	**122,6**	**310,2**	**562,3**	**1.120,9**	**2.596,0**	**5.194,7**	**15.036,9**	**20.491,6**	**26.639,1**
Long-term Investments	-	-	-	-	-	-	-	5,3	6,9
Goodwill	-	-	-	-	-	-	-	60,2	78,3
Other Intangibles	14,5	14,5	14,3	-	-	12,8	376,1	361,5	470,0
Accounts Receivable Long-Term	-	-	-	-	-	-	506,3	456,7	593,6
Deferred Charges, LT	7,1	6,4	5,8	-	-	-	-	-	
Other Long-Term Assets	6,0	9,5	7,1	30,1	54,6	78,4	484,9	709,5	922,4
Total Assets	**386,1**	**713,4**	**1.114,2**	**2.416,9**	**5.830,7**	**8.067,9**	**22.664,1**	**28.655,4**	**37.252,0**
3Y asset growth								*70,0%*	
2Y asset growth								*88,5%*	
1Y asset growth								*26,4%*	
LIABILITIES									
Accounts Payable	29,0	56,1	303,4	304,0	777,9	916,1	1.860,3	2.390,3	3.107,3
Accrued Exp.	16,5	29,1	27,0	50,3	123,0	227,4	803,8	1.207,3	1.569,4
Curr. Port. of LT Debt	-	7,9	50,8	0,2	669,3	675,2	1.211,0	963,9	1.253,1
Curr. Port. of Cap. Leases	0,3	1,1	4,4	7,7	21,0	1,3	-	14,9	19,4
Curr. Income Taxes Payable	2,7	1,0	9,7	38,1	71,2	101,2	152,9	185,8	241,5
Unearned Revenue, Current	4,6	2,3	1,9	91,9	191,7	424,0	763,1	1.015,3	1.319,8
Other current Liabilities	32,5	93,8	141,9	183,1	311,2	513,1	1.044,7	1.897,3	2.466,5
Total Current Liabilities	**85,6**	**191,3**	**539,1**	**675,2**	**2.165,4**	**2.858,3**	**5.835,8**	**7.674,7**	**9.977,2**
								52,5%	
								63,9%	
								31,5%	
Long-Term Debt	71,8	268,3	401,5	586,1	1.818,8	2.021,1	6.053,9	9.486,2	12.332,1
Capital Leases	0,5	2,8	10,0	12,9	31,4	201,4	1.323,3	1.665,8	2.165,5
Unearned Revenue, Non-Current	2,8	3,1	3,1	181,2	292,3	446,1	851,8	1.177,8	1.531,1
Def. Tax Liability, Non-Curr.	-	-	0,3	-	-	-	-	-	
Other Non-Current Liabilities	18,4	23,8	35,5	294,5	611,1	1.457,3	2.694,2	3.018,5	3.924,0
Total Liabilities	**179,0**	**489,4**	**989,5**	**1.749,8**	**4.919,0**	**6.984,2**	**16.759,0**	**23.023,1**	**29.930,0**
								67,3%	
Common Stock	0,1	0,1	0,1	0,1	0,1	0,1	0,2	0,2	0,2
Additional Paid In Capital	621,9	893,3	1.190,2	1.806,6	2.345,3	3.409,5	7.773,7	9.178,0	11.926,6
Retained Earnings	(415,0)	(669,4)	(1.065,6)	(1.139,6)	(1.433,7)	(2.322,3)	(2.997,2)	(4.974,3)	(6.461,7)
Treasury Stock	-	-	-	-	-	-	-	-	
Comprehensive Inc. and Other	-	0	-	-	0	(3,6)	(23,7)	33,3	43,4
Total Common Equity	**207,0**	**224,0**	**124,7**	**667,1**	**911,7**	**1.083,7**	**4.752,9**	**4.237,2**	**5.508,4**
Minority Interest	-	-	-	-	-	-	1.152,2	1.395,1	1.813,6
Total Equity	**207,0**	**224,0**	**124,7**	**667,1**	**911,7**	**1.083,7**	**5.905,1**	**5.632,3**	**7.322,0**
Total Liabilities And Equity	**386,1**	**713,4**	**1.114,2**	**2.416,9**	**5.830,7**	**8.067,9**	**22.664,1**	**28.655,4**	**37.252,0**

Appendix 7

restructuring

DCF Model -Base Case In million USD	Actual 2010	Actual 2011	Actual 2012	Actual 2013	Actual 2014	Actual 2015	Actual 2016	Actual 2017	Base 2018	2012-2017 CAGR	2013-2017 5Y ø on revenue	Adjustments	Adjusted 2018	Forecast 2019	Forecast 2020	Forecast 2021	Forecast 2022	Forecast 2023	Forecast 2024	Forecast 2025	Forecast 2026	Forecast 2027	Forecast 2028	Forecast TV
Total Revenue	117	204	413	2.013	3.198	4.046	7.000	11.759	18.981	95%	100%		18.981	24.632	30.309	37.704	46.791	52.483	62.765	68.743	78.468	85.597	91.970	**93.350**
YOY % change		75%	102%	387%	59%	27%	73%	68%	61%					30%	23%	24%	24%	12%	20%	10%	14%	9%	7%	
Cost Of Goods Sold	(86)	(143)	(383)	(1.557)	(2.317)	(3.123)	(5.401)	(9.536)	(15.515)	90%	78%		(15.515)											
YOY % change		66%	169%	306%	49%	35%	73%	77%	63%															
Gross Profit	**31**	**62**	**30**	**456**	**882**	**924**	**1.599**	**2.222**	**3.465**	136%	-22%	116	**3.582**											
Selling General & Admin Exp.	(85)	(104)	(150)	(286)	(604)	(922)	(1.410)	(2.451)	(2.889)	75%	20%		(2.889)											
YOY % change		23%	44%	90%	111%	53%	53%	74%	18%															
R & D Exp.	(93)	(209)	(274)	(232)	(465)	(718)	(834)	(1.378)	(1.472)	38%	13%		(1.472)											
YOY % change		125%	31%	-15%	100%	54%	16%	65%	7%															
EBIT	(147)	(251)	(394)	(61)	(187)	(717)	(646)	(1.606)	(896)	32%	11%		(780)	(553)	963	2.142	4.073	4.245	5.334	6.296	7.429	8.543	9.312	9.452
YOY % change		71%	57%	-84%	205%	284%	-10%	149%	-44%					-29%	na	122%	90%	4%	26%	18%	18%	15%	9%	1,5%
EBIT	(147)	(252)	(394)	(61)	(187)	(717)	(646)	(1.606)		32%	-643													
check1	(0)	0	0	0	0	(0)	(0)	0		-4%	0													
Tax rate	0%	0%	0%	0%	0%	0%	0%	0%	0%					0%	25,5%	25,5%	25,5%	25,5%	25,5%	25,5%	25,5%	25,5%	25,5%	25,5%
EBIT after tax	(147)	(251)	(394)	(61)	(187)	(717)	(646)	(1.606)	(896)	32%	11%		(780)	(553)	717	1.595	3.033	3.160	3.972	4.688	5.531	6.361	6.934	7.038
YOY % change														-29%	na	122%	90%	4%	26%	18%	18%	15%	9%	1,5%
Depreciation & Amortisation	(11)	(17)	(29)	(106)	(232)	(423)	(947)	(1.636)	(1.855)				(1.855)											
Other Amortization	0	0	0	0	0	(78)	(95)	(91)	(161)				(161)											
Total Depreciation & Amortisation	(11)	(17)	(29)	(106)	(232)	(501)	(1.042)	(1.727)	(2.016)	127%	13%		(2.016)	(2.077)	(2.217)	(2.437)	(2.687)	(2.630)	(2.732)	(2.819)	(2.185)	(2.175)	(2.250)	(2.284)
YOY % change		59%	70%	268%	119%	116%	108%	66%	17%					3%	7%	10%	10%	-2%	4%	3%	-22%	0%	3%	1,5%
Gross Property, Plant & Equipment	145	344	623	1.281	2.972	5.982	16.454	23.169	30.119	106%	178%		30.119											
Net Property, Plant & Equipment	123	310	562	1.121	2.596	5.195	15.037	20.492	26.639		159%		26.639	39.411	48.495	60.326	74.866	83.973	100.424	109.989	125.549	136.955	147.152	149.359
Accumulated Depreciation	(22)	(34)	(61)	(160)	(376)	(788)	(1.417)	(2.677)	(3.480)	113%	19%		(3.480)											
Annual Depreciation	na	(12)	(27)	(99)	(216)	(412)	(630)	(1.260)	(803)	116%	9%		(803)											
Degree of wear			10%	12,5%	12,6%	13,2%	8,6%	11,6%	12%		11,7%													
Capital Expenditures	na	(211)	(305)	(756)	(1.907)	(3.423)	(11.101)	(7.975)	(7.754)	92%	90%		(7.754)	(1.817)	(2.676)	(3.009)	(3.204)	(3.345)	(3.467)	(3.525)	(3.372)	(3.444)	(3.584)	(2.284)
YOY % change		na	45%	148%	152%	79%	224%	-28%	-3%					-77%	47%	12%	6%	4%	4%	2%	-4%	2%	4%	-36%
Total Cash	100	255	202	846	1.906	1.197	3.393	3.368	2.968	76%			2.968											
YOY % change		156%	-21%	319%	125%	-37%	183%	-1%	-12%															
Excess cash	94	245	181	745	1.746	995	3.043	2.780	2.018				2.018											
Operating Cash	6	10	21	101	160	202	350	588	949				949											
Accounts Receivable	7	10	27	49	227	169	499	515	1.155				1.155											
Inventory	45	50	269	340	954	1.278	2.067	2.264	3.314				3.314											
Prepaid Exp.	11	9	8	28	76	108	194	268	325				325											
Restricted Cash	74	23	19	3	18	23	106	155	159				159											
Other Current Assets	-	-	-	-	-	7	-	-	-				-											
Accounts Payable	29	56	303	304	778	916	1.860	2.390	3.597				3.597											
Accrued Exp.	17	29	27	50	123	227	804	1.207	1.696				1.696											
Curr. Port. of LT Debt	-	8	51	0	669	675	1.211	964	2.107				2.107											
Curr. Port. of Cap. Leases	0	1	4	8	21	1	-	15	109				109											
Curr. Income Taxes Payable	3	1	10	38	71	101	153	186	0				0											
Unearned Revenue, Current	5	2	2	92	192	424	763	1.015	571				571											
Other current Liabilities	33	94	142	183	311	513	1.045	1.897	1.696				1.696											
Operating Working Capital	57	(89)	(196)	(154)	(731)	(1.071)	(2.619)	(3.884)	(3.873)	82%	30%		(3.873)	(7.390)	(9.093)	(11.311)	(14.037)	(15.745)	(18.829)	(20.623)	(23.540)	(25.679)	(27.591)	(28.005)
YOY % change		-257%	121%	-21%	373%	46%	145%	48%	0%					91%	23%	24%	24%	12%	20%	10%	14%	9%	7%	1,5%
Change in Working Capital		(145)	(107)	41	(577)	(340)	(1.548)	(1.265)	11	64%			11	(3.516)	(1.703)	(2.218)	(2.726)	(1.708)	(3.085)	(1.794)	(2.917)	(2.139)	(1.912)	(1.941)
Free Cash Flow to Firm		***(591)***	***(778)***	***(670)***	***(2.439)***	***(3.978)***	***(12.253)***	***(9.119)***	***(6.623)***	***64%***			***(10.538)***	***(3.809)***	***(1.445)***	***(1.196)***	***(210)***	***738***	***152***	***2.188***	***1.427***	***2.954***	***3.688***	***5.097***
Probability of default													3,8%	3,8%	5,5%	5,9%	4,9%	4,4%	4,0%	3,2%	2,7%	2,5%	2,0%	
FCFF going concern assumption													(10.134)	(3.663)	(1.366)	(1.125)	(200)	705	146	2.119	1.389	2.880	3.616	5.097
Total assets	386	713	1.114	2.417	5.831	8.068	22.664	28.655	37.252	91%	241%		45.553	59.117	72.742	90.490	112.299	125.959	150.635	164.984	188.323	205.433	220.728	
FCFF liquidation assumption													1.050	1.362	2.387	3.225	3.315	3.348	3.588	3.118	2.994	3.057	2.583	
WACC													8,2%	8,2%	8,2%	8,2%	8,2%	8,2%	8,2%	8,2%	8,2%	8,2%	8,2%	8,2%
ROCE	-82%	-113%	-107%	-6%	-10%	-17%	-5%	-10%	-4%				-3,4%	-1,7%	1,8%	3,3%	5,0%	4,6%	4,9%	5,2%	5,4%	5,7%	5,8%	5,8%
Discount Factor													0,98	0,91	0,84	0,77	0,72	0,66	0,61	0,57	0,52	0,48	0,45	6,67
PVs of FCFs													(8.907)	(2.085)	856	1.626	2.229	2.681	2.283	2.959	2.289	2.866	2.765	33.974
Enterprise value as of 30.09.2018													***43.535***											
+ Excess cash													2.819											
- Minority interest													-1344,731											
- Gross financial debt													-11833,127											
- Capital leases													-1622,059											
- Restricted stock units													-337,32											
- Stock options													-2015,53											
Equity value as of 30.09.2018													***29.202***											
Shares outstanding													171.732.775											
Value per share													170,04											

Abstract in German

Diese Masterarbeit behandelt einerseits Teslas (Tesla, Inc.) Geschäftsmodell sowie die damit einhergehenden geschäftsbezogenen und finanziellen Risiken um ein stimmiges sowie belastbares Bewertungsmodell zu kreieren. Mit diesem werden Teslas Aktien zum 30. September 2018 bewertet. Eine Schlüsselrolle kommt hierbei der Analyse wesentlicher Werttreiber zu, mit deren Hilfe verstanden werden soll wie Tesla Umsätze generiert und auf lange Sicht das Geschäftsmodell profitabel werden kann. Um Teslas Risikoprofil zu evaluieren wird auf verschiedene Risikofaktoren eingegangen, mit denen das Unternehmen konfrontiert ist. Darüber hinaus wird Teslas Kapitalstruktur betrachtet und hybride Bestandteile bewertet. Um Teslas Gesamtunternehmenswert sowie Marktwert des Eigenkapitals zu berechnen wird die Anwendbarkeit verschiedener Bewertungsmodelle diskutiert. Das DCF Modell zum Ableiten des Gesamtunternehmenswerts wird hierbei als das geeignetste Modell identifiziert. Die Masterarbeit zeigt folglich die Berechnung des intrinsischen Wertes einer Tesla Aktie unter Berücksichtigung verschiedener Szenarien. Zur Plausibilisierung des Bewertungsergebnisses wird das Multiplikatorverfahren verwendet.