University of Economics in Prague

Faculty of Finance and Accounting

Finance and Accounting

MASTER THESIS

Valuation of Tesla, Inc.

Author: Schueller Christoph Markus

Supervisor: Doc. Ing. Krabec Tomas, Ph.D., MBA

Academic Year: 2017/2018

Declaration of Authorship

The author hereby declares that he compiled this thesis independently, using only the listed resources and literature, and the thesis has not been used to obtain a different or the same degree.

The author grants to University of Economics in Prague permission to reproduce and to distribute copies of this thesis document in whole or in part.

Prague, 30.05.2018.

Signature

Abstract

Valuation is the process of determining the intrinsic value of any asset. However, for companies that are considered to be rather young, in a period of growth, highly complex in its business model or under financial distress, among others, this process turns out to be rather difficult and not very precise in its outcomes. Tesla is one of those companies showing characteristics of a strongly growing, complex business which is currently also undergoing financial difficulties. This thesis investigates possible ways of approaching these matters and aims to set a valuation framework which provides an adequate and reasonable path of valuing those businesses. Therefore theoretical background and extensive information about business model and market trends was gathered to set the fundament for the practical valuation approach of the company. The thesis applies a discounted cash flow valuation based on free cash flows to the firm in order to retrieve Tesla's intrinsic value. The findings of the thesis allow conclusions about Tesla's business model, competitive position in the market and consequently the reasonability of Tesla's current share price. For companies considered to be rather similar in their characteristics, this thesis provides a valuation framework which can be applied to retrieve a first impression of those companies' intrinsic value.

JEL Classification	G310, G320, G330.
Keywords	Business Valuation, Capital Structure, Cost of Capital, Discounted Cash Flow Valuation, Electric Vehicles, Elon Musk, Liquidation, Personal Brand Value, Tesla, Value of Equity.

Content

List of Tables

List of Figures

Acronyms

ASP	Average Selling Price
BEV	Battery Electric Vehicle
BV	Book Value
CAGR	Compound Annual Growth Rate
CAPEX	Capital Expenditures
CEO	Chief Executive Officer
DCF	Discounted Cash Flow
D/E	Debt to Equity
EPS	Earnings per Share
EV	Electric Vehicle
FCFE	Free Cash Flow to Equity
FCFF	Free Cash Flow to the Firm
ICE	Internal Combustion Engine
MV	Market Value
NOPLAT	Net Operating Profit less Adjusted Taxes
OEM	Original Equipment Manufacturer
PHEV	Plug-In Hybrid Electric Vehicle
ROIC	Return on invested Capital
ROC	Return on Capital
R&D	Research and Development
SUV	Sport Utility Vehicle
TSM	Treasury Stock Method
TV	Terminal Value
WACC	Weighted Average Cost of Capital
YoY	Year over Year
ZEV	Zero Emission Vehicle

1 Introduction

There is a story behind every business success and every business failure, sometimes the story of a great idea, sometimes one that failed. Sometimes it's a story of insightful management, or management that failed. But almost always it's a story about change. Change in the market; change in the economy; change in a particular product or service that transformed a failure into success, or vice versa (Morris, 2013).

One company that could add another chapter to this story is Tesla. It is this company, which is operating in the electric vehicle (EV) market, offering pure battery electric vehicles in the premium to upper car segment in conjunction with its in-house energy production and energy storage systems, which turn Tesla into a vertically integrated company, almost uniquely in the current vehicle market, providing them with the highest attention among all car manufacturers worldwide. The company well-known for its CEO Elon Musk, who is at least as controversially discussed among analysts and investors as the company itself. Tesla's stock started trading on NASDAQ in 2010 with an opening share price of $17,00 resulting in a market capitalization of $226 million. Only seven years later, in August 2017, Tesla reached a market capitalization of $58,7 billion, turning it into the 4th largest automaker by value (Visual Capitalist, 2017) worldwide and the number one in the U.S. with a market capitalization higher than these of established car manufacturers like General Motors and Ford. An interesting aspect about the rapid development of the share price is that during the period of this extremely high market capitalization Tesla was only able to generate a fraction of its competitors' annual car sales and even accounted for negative earnings, which is still the case in 2017 when the stock price was trading at $311,64 as of 31st of December 2017. These facts evoked discussions about the reasonability of the stock price development over the years with analysts providing valuation frameworks justifying share prices from $0 to more than $500. Tesla still remains one of the most controversial stocks in the U.S. stock market, with opinions ranging from saying that the equity is worthless (McEachern, 2017) to Tesla changed the auto industry forever (Hawkins, 2017). However, current negative events around the production delay of Tesla's Model 3 raised additional sceptics about a successful future of the company. This sceptics is also reflected in the current short position volume of Tesla of $10,7 billion, thus being the most shorted stock on the entire U.S. market.

This thesis wants to catch up with the problematics and discussions related to Tesla and its business model and provide a framework for the valuation of the company to give an answer to the research question of this thesis:

Tesla Inc. – Is the share price as of 31st of December 2017 reasonable?

1.1 Purpose

The purpose of this study is to investigate the factors of influence on the share price of Tesla and to put these results into an appropriate valuation framework to arrive at a reasonable share price for Tesla. This comprises an analysis of Tesla's business model and competitive advantages in conjunction with extensive market and competitor research and analysis. Illustrated is also the choice of the valuation technique and model with underlying arguments confirming the chosen valuation model. The results of the valuation are of interest for any analyst or private person, considering investments into Tesla as well as for anyone interested in valuing controversial companies. Furthermore the paper also provides extensive research on the future development of the electric vehicle market and its key players as it is relevant to estimate Tesla's future role in the EV market.

1.2 Contribution

This study contributes to existing literature and valuation papers in two ways. Firstly, it provides an extensive research and analysis of the underlying electric vehicle market in the present and future by bundling research papers of different investment banks such as UBS, Blackrock or Morgan Stanley and applying these assumptions, including the researcher's own opinion on future market developments, on the paper's own valuation model. Secondly, it describes different scenarios, meaning sensitivity analysis, to estimate a range of share values for Tesla which then serves as the basis of the valuation paper to describe the circumstances and reasonability of the current share price of Tesla and its market capitalization and which provide the fundament for answering the research question.

1.3 Scope

The scope of the study comprises data of Tesla, retrieved from its Annual Reports of 2012 – 2017. Additionally, sales data of the total passenger car market, the total EV market and both the battery electric vehicle (BEV) market and plug-in hybrid electric vehicle market (PHEV) were retrieved to provide a benchmark for current and future growth of Tesla. This comprises companies worldwide, which are or will be active in the EV market in the future. The valuation of Tesla will be conducted by using a Discounted Cash Flow model, meaning to discount expected future cash flows of the company back to its present value. For the purpose of the valuation of Tesla the free cash flow to the firm (FCFF) model was applied due to arguments provided below. Aswath Damodaran, professor at the Stern School of Business at the New York University, provides extensive literature to these topics which are used as the thesis' fundament and framework.

2 Literature review

Valuation is an area within finance that caught attention from various researchers and practitioners for a long time. Thus, the amount of available literature is extensive. Nevertheless, the choice of the underlying literature is of high importance as it will serve as the fundament for the valuation framework of Tesla. Aswath Damodaran, professor at the Stern School of Business at the New York University, is one of the most renowned professors in this area.

In his book "Investment Valuation: Tools and Techniques for Determining the Value of Any Asset" he is providing extensive knowledge about the entire procedure of asset valuation. In 36 chapters he summarizes applications ranging from growth estimations over cash flow calculations to inputs of the discount rate such as the risk-free rate or the equity risk premium and its calculation. He says that every asset can be valued, but some assets are easier to value than others, and the details of valuation will vary from case to case (Damodaran, 2012). In the chapters "Valuing Firms with Negative or Abnormal Earnings" and "Valuing Young or Start-up Firms" he provides extensive research and knowledge about dealing with negative earnings and unstable growth rates, both applicable to Tesla in conjunction with possible solutions for the purpose of valuation.

By putting a specific spotlight on research and methods of valuing young, distressed and complex businesses Damodaran provides valuation methods explicitly for growth companies, such as Tesla, with issues of survival, volatile operating histories and growth and changing risk profile (Damodaran, 2010). He introduces the reinvestment rate, illustrating the rate that the firm must make to deliver this growth (Damodaran, 2010) of the company, turning it into an important input in the DCF model.

For the purpose of valuation, financial statements have to be adjusted in order to generate meaningful results. Joshua Rosenbaum and Joshua Perl describe adjustments in terms of normalization of financial statements and the calculation of fully diluted shares outstanding using the treasury stock method for options and warrants and the if-converted method for convertible and equity-linked securities.

Yet another adjustment that needs to be done is the adjustment for operating leases. This adjustment is recommended by Damodaran to reflect the fact that operating lease expenses really represent financing expenses, with adjustments of operating income, capital, profitability and cash flow measures (Damodaran, Dealing with Operating Leases in Valuation, 2007).

Damodaran also provides solutions for the adjustment of research and development expenses (R&D) which also have to be capitalized. He argues that these expenses "should be treated as tax-deductible capital expenditures" (Damodaran, 2007 (II), p. 2) at least for valuation purposes and that these adjustments can have significant influence on ratios for companies with substantial (R&D) expenses.

For the purpose of valuation the analysis and sustainability of the business model is considered a significant input. Langdon Morris calculated that over a time span of 46 years, an annual average of 30 companies left the Fortune 500 list with the list comprising the world's largest companies. He argues that to ensure a going-concern of companies the business model has to be changed and adopted to the current or possible future situation in the market and that many companies fail to do so as they rely too much on past success. Furthermore the paper allows conclusions for the analysis of competitive advantages and implies that these advantages cannot be solely obtained by expenses in R&D but by changes in the entire business model along the entire value chain.

The basis for the analysis of the business model forms the annual reports of Tesla of 2015 – 2017 as they describe into details Tesla's main value drivers. Additionally, detailed information about these value drivers, such as growth rates, expenditures, margins and future plans are supplied. The reports also provide the basis for the financial data used in the valuation process, which were retrieved from Tesla's income statements, balance sheets, cash flow statements and their appendixes.

Furthermore investment banks such as UBS, Morgan Stanley, Blackrock and McKinsey deliver research papers about the current situation and future influences in the automotive sector and the development of the EV market on a regular basis. The UBS research paper "Q-Series: UBS Evidence Lab Electric Car Teardown – Disruption Ahead?" expects one billion electric vehicles by 2050. Moreover, it provides research on the topic of Total Cost of Ownership (TCO) by comparing production price developments in the EV market to these of the internal combustion engine (ICE) market. The paper argues that by 2018 TCO is reached in Europe, by 2023 in China and by 2025 in the U.S. and it models the entire EV growth separated by region until 2025 which both will be included in the later estimation of EV market and sales units. It also splits up costs of the Model 3 which allows conclusions and adoptions to own assumptions for the purpose of margin calculations of Tesla and the check for reasonability of own assumptions.

The future market size of the EV market was also researched by Blackrock which also estimates a total of one billion electric vehicles by 2050 (Black Rock Investment Institute, 2017). Total EV costs are expected to fall as well as an increase in the charging infrastructure, but it is not assumed that these trends disrupt the automotive market before 2020. Besides the research on total EV sales the research paper also provides a measure of total revenues, which are strongly increasing between 2016 and 2030, according to Blackrock. The paper also states that lower resources of oil and the increase in electricity demand will not affect the automotive market significantly.

One billion EVs are also expected by Morgan Stanley to be on the road by 2050. The research papers "On the Charge" and "Auto Industry Braces for the Electric Shock" also admit that battery electric vehicles "still have a plenty of hurdles to clear" (Morgan Stanley Research Center, 2017 (II), p. 3) with cost

reduction, future technologies and consumer acceptance being the main issues according to the paper. An increase in electricity demand is also not considered to be a challenge as the network management for peak demand and the concentrations of charging points will increase throughout the following years. Morgan Stanley also describes that the competition in the market will grow rapidly in the next years, as especially established car manufacturers like BMW or Volkswagen will ramp up their EV production significantly. The paper On the Charge also provides different scenarios and estimations for the future EV market growth which will be incorporated into this thesis.

Besides the literature described above, further reports and research papers were analyzed.

Conclusively, valuation methods including these of start-up and growth companies have been investigated by several researches and especially the research papers provided by Damodaran represent a profound technical fundament. Thereby the Annual Reports of Tesla for the years 2015 -2017 retrieve all information necessary to extract the numerical basis for the valuation. Additionally, all further information, for example related to future investments or business model, can be found in the Annual Reports. The business model is analyzed and evaluated with the help of the research paper "Business Model Warfare" by Langdon Morris. Research papers by investment banks are mainly used to analyze the total car and EV market in order to create own forecasts of future EV sales based on the underlying literature provided.

3 Research question and hypotheses

The research question is:

Tesla Inc. – Is the share price as of 31st of December 2017 reasonable?

Firstly, data of the business model of Tesla are retrieved from Tesla's Annual Reports, which will then be analyzed by applying the results of the research paper Business Model Warfare. This also includes deriving Tesla's competitive advantages in the market which ensure future survival, growth and high profitability of the company. This is followed by incorporating and analyzing data provided by several research papers of investment banks related to the EV market, including forecasts of the EV market. An additional competitor analysis will lead to a reasonable forecast of Tesla's future revenues, which is the basis of the FCFF valuation. After calculating and discounting these cash flows, net debt will be subtracted to arrive at the equity value. This will be divided by the fully diluted shares outstanding to arrive at the value per share.

This thesis provides a framework to understand the dynamics and main value drivers of Tesla and its per share value. Moreover, it will identify the reasonable valuation range for Tesla by bundling all information provided by different research papers and reports into one valuation model. The results of this thesis can be compared to results of academics and analysts and it can be put into relation to the current share price of Tesla.

Based on the research question which was defined above the following hypotheses will be tested:

Hypothesis 1: Tesla's share price as of 31st of December 2017 is priced to perfection.

As all valuations provide a range of possible per share values through conducting sensitivity analysis , it is expected that the per share price of Tesla as of the 31st of December 2017 is located on the upper limit of this range and not showing any upside potential. It should also indicate that by aligning all valuation inputs to the optimum reasonable threshold for Tesla, the calculated share value should align to the share price as of the 31st of December 2017.

Hypothesis 2: Tesla's business model is superior to these of its closest competitors.

Tesla claims itself as the "world's only vertically integrated sustainable energy company" (Tesla Inc., 2018, p. 1). The company offers end-to-end clean energy products comprising fully electric vehicles as well as solar energy generation and storage products. This is assumed to be a unique characteristic of the company granting them competitive advantages over its worldwide competitors. Therefore it is expected

that also Tesla's business model is superior to those of its closest competitors. However this assumption needs to be further investigated.

Hypothesis 3: Elon Musk has significant influence on the value of Tesla.

A new 10-year compensation plan which was approved by Tesla's shareholders and which is depending on reaching advancing milestones in the company's performance, grants Musk additional stock options in case these thresholds are reached. The total compensation in case of fulfilling all milestones is worth up to $200 billion. The hypothesis is that Musk, the beneficiary of this contract, needs to have a significant influence on the value of Tesla, that such a compensation package is approved.

4 Valuation – theoretical perspective

For valuation purposes of companies or assets in general, different valuation techniques are applicable. The following three methods, which are generally considered mainly used for valuation purposes and which are also are incorporated in the valuation book "Investment Banking: Valuation, Leveraged Buyouts, and Mergers & Acquisitions" by Joshua Rosenbaum and Joshua Perl, are:

- Comparable Company Analysis
- Precedent Transactions Analysis
- Discounted Cash Flow Analysis:
  Free cash flow to the firm (FCFF) and free cash flow to equity (FCFE)

There are several drawbacks of the two relative valuation options:

1. No comparable companies with similar risk and growth characteristics and a similar capital structure in comparison to Tesla.
2. Tesla's multiples differ significantly from these of other publicly traded firms in the industry, as these firms are mostly mature companies.
3. Most of the other firms' value comes from assets in place, whereas Tesla mainly generates its value from growth assets → understatement of value of Tesla.
4. No precedent transactions in the market that can be used as a benchmark.

Consequently, for the purpose of the valuation of Tesla, a discounted cash flow (DCF) model is applied "to receive the assets intrinsic value which reflects both its cash flow potential and its risk" (Damodaran, 2010, p. 22).

The free cash flow to the firm is calculated by discounting back the future expected cash flows of the asset to receive the present value of these cash flows. For the valuation of Tesla a DCF model is used to calculate the enterprise value through its free cash flows to the firm (FCFF). This means to value the entire business "with both existing assets (assets-in-place) and growth assets" (Damodaran, 2010, p. 23). The enterprise value will then be adjusted by netting out the value of all non-equity claims to arrive at Tesla's value of equity.

For the valuation of Tesla financial figures and statements will be used as of 31st of December 2017 and therefore the company will be valued for this point in time.

The FCFF method was assessed superior to the FCFE method in case of Tesla for the following reasons:

- Estimating cash flows to equity if debt ratio is changing over time is much more complicated than estimating the cost of capital over time. The FCFE method requires "to forecast new debt issues, debt repayments, and interest payments each period, as the dollar debt changes" (Damodaran, 2010, p. 281) which is almost impossible on a precise level.
- Consequently FCFE preferred if company no or low portion of debt which will sustain in perpetuity. However, Tesla permanently issues bonds → FCFF method preferred as it is more flexible to adjust for these changes.
- FCFF more flexible with assumptions being adjusted over time.

After determining the valuation approach for Tesla, the following chapter describes the underlying valuation theory to determine the value of Tesla, Inc.

4.1. Underlying valuation theory of Tesla and inputs into a DCF valuation using FCFF method

After determining the valuation approach for Tesla, the following chapter describes the underlying valuation theory to determine the value of Tesla, Inc. Main inputs into a DCF model based on discounting free cash flows to the firm are:

1. Cash flow from existing assets: reflect pre-debt earnings of FCFF
2. Growth: growth in operating income key input when valuing entire business, also growth assets
3. Discount rate: reflect the firm's overall cost of capital
4. Terminal value: Firm's estimated value at the end of the forecast period

These figures are key inputs to determine the intrinsic value of Tesla. Subsequent the single points are described into details to set the framework for the practical valuation.

4.1.1. Cash flow to the firm

The key drivers of the free cash flows to the firm are revenues through its growth rates and operating margins and its growth rates. The general formula for FCFF is:

Free cash flow to the firm (FCFF) = After-tax Operating Income – Reinvestment
= After-tax Operating Income – (Capital Expenditures – Depreciation + Δ Working Capital)
= EBIT (1 – t) * (1 – Reinvestment Rate)

$$\text{And the Reinvestment Rate} = \frac{(\text{Capital Expenditures} - \text{Depreciation} + \Delta \text{ Working Capital})}{\text{After-tax Operating Income}}$$

$$= \frac{\text{Revenues}_t - \text{Revenues}_{t-1}}{\left(\frac{\text{Sales}}{\text{Capital}}\right) \text{ratio}}$$

If Reinvestment rate > 100% → company has substantial reinvestment needs
and if Reinvestment rate < 0% → company has divesting assets and decreasing capital.

Important: The FCFF "is the basis for all cash distributions made by the firm to its investors. Dividends, stock buybacks, interest payments, and debt repayments all have to be made out of these cash flows" (Damodaran, 2010, p. 28). Consequently, in case of negative FCFFs, these obligations cannot be met.

The sales-to-capital ratio, which was used in the second equation to determine the reinvestment rate, can be described by the following formula:

$$\text{Sales-to-Capital ratio} = \frac{\text{Revenues}}{(\text{Book Value of Debt} + \text{Book Value of Equity} - \text{Cash and Marketable Securities})}$$

The ratio describes the effectiveness with which the business is growing. A higher ratio thereby implies higher effectiveness as the same amount of capital can create a higher amount of revenues. This ratio, which is described by Damodaran, will be applied for computing Tesla's future reinvestment needs.

4.1.2 Growth rates

The value of a business can also be described as a function of the expected earnings growth rate as higher growth rates in earnings usually translate into higher value of the firm. Furthermore growth is not an exogenous input but has to be earned by the firm. Growth comprises both historical and forecasted growth rates (Damodaran, 2010).

Historical growth rates can have different estimates for the same company for the following reasons:

- Measurement of earnings: Different growth measures for different figures may vary strongly over a defined time period.

- Period of analysis: Long-horizon growth rates can differ heavily from short-horizon growth rates.
- Averaging approach: Different rates related to different averaging methods, depending on for example arithmetic or geometric average.

Damodaran also states that "a debate on how best to estimate historical growth makes sense only if it is a good predictor of future growth" (Damodaran, 2010, p. 40). However, studies showed that:

- The relationship between past and future growth is very weak.
- Scaling matters → growth in companies results in decrease of growth.
- Firms and sectors grow through growth cycles, with high growth in one period followed by low growth in the next.

The consequence is that for a precise analysis reliance on both historical growth rates and estimates of equity analysts is not of high precision. Damodaran solves this problem by applying fundamental growth rates with the firm's growth rates being a function of only two variables – the return the company generates on new investments (ROI) and the earnings proportion put into new investments ($\Delta I/E_{\tau-1}$).

Fundamental growth rates

A company can grow due to two different growth measures: growth from new investments and efficiency growth. Table 1 gives a short overview of how to compute these measures.

Table 1: Fundamental growth rates

	Change in Investment	Measure of Return on existing Assets	Efficiency Growth
Operating income	Reinvestment Rate	Return on (invested) Capital (ROC or ROIC)	$\frac{ROC_t - ROC_{t-1}}{ROC_{t-1}}$

Table 1 illustrates both measures of growth and implying that growth in a company can come either from new investments or improvements in efficiency or both. Growth from new investments is connected to investment cost whereas growth in efficiency comes with no concurrent cost (Damodaran, 2010).

For valuation purposes there are four key measures for which to determine historical and future growth. These are EBITDA, EBIT, net income (calculated before or after extraordinary items) and earnings per share (calculated on primary shares outstanding or fully diluted shares outstanding). These measures of earnings differ in their growth rates. According to Damodaran the following reasons can be responsible for this issue which is also considered in the case of Tesla:

1. Changes in operating performance: Function of revenues and operating margins, can include periods of company growth (higher revenues both lower margins) or phases of profitability improvement (higher margins and probably lower growth in revenues).
2. Operating leverage: High operating leverage = high fixed costs → small changes in revenues can translate into large changes in operating income.
3. Financial Leverage: High financial leverage = high fixed costs of interest expenses → can make equity earnings (net income and EPS) more sensitive to changes in operating income.
4. Dividend policy: If number of shares outstanding remain same over time → changes in net income = changes in EPS, if stock buy backs → EPS growth > net income growth.
5. Noise variables: Net income includes income and expense items that are not part of the operating income computation → income from cash, marketable securities and minority holdings in other companies are reported in net income but not in operating income. If these items volatile, will lead to deviation of net income growth to operating income growth.

Furthermore Damodaran describes five propositions for correctly determining the growth rates of companies which will be added by one own proposition:

Proposition 1: Generally moving up the income statement will tend to decrease the growth rates.

Proposition 2: Level of detail in forecast has to increase if you expect changes in operating efficiency, operating leverage, financial leverage and/or dividend policy. With changes in these issues, the growth rates will differ over the years and between the single profitability measures due to improvements which will affect some profitability measures and not others. Therefore the margins and growth rates have to be adjusted each year separately.

Growth related to sector:

- Different position in life cycle of the sector → younger sectors usually deliver higher growth rates
- Competition in the sector → less competition makes it possible for companies to deliver higher growth rates.
- Macroeconomic influences and movements.

Typically the revenue growth rate of a newly public company outpaces its industry average only about five years. In the beginning IPO-companies have a 15% higher revenue growth rate than the industry which will then converge to industry average in year 5.

Proposition 3: Scaling up is hard to do. The expected growth rate for a firm should be tied to the size of the firm, with growth rates decreasing as the firm gets larger.

(Own) Proposition 4: According to a study by Chan, Lakonishok and Karceski (2003) which were testing persistence and predictability of growth rates by looking at earnings of U.S. firms from 1951 to 1997 they concluded that the median growth rate in earnings across firms corresponds closely to growth in GDP, high growth was uncommon and that there was no persistence, albeit small, in revenue growth at firms. This fact will be used as a guideline for terminal value assumptions of Tesla.

Proposition 5: There is little predictive value in historical growth rates and high growth rates in the past are not indicative of high growth rates in the future. To the extent that there is predictability, revenue growth is a little more persistent than earnings growth and periods of high earnings growth are more likely to be followed by low than high earnings growth → Historical growth rates are backward looking but focus of investing is on expected future growth → especially of high importance in case of Tesla.

For public companies → market price provides an implicit estimate of the expected growth in earnings in the future and assuming market efficiency there should be information in these implied earnings growth rates.

Proposition 6: Analyst estimates of earnings and growth have some predictive value for short-term earnings forecasts, but are of little or any value for long-term growth forecasts.

Besides research analyst forecasts also management forecasts can be taken into account as they have detailed information which no outsider can access and furthermore the management is also able to directly influence future growth. However, these forecasts are released to a big potential of biases as the management tends to overestimate the growth in their own firm.

Therefore market growth rates are analyzed and forecasted as a benchmark of Tesla's future growth in conjunction with Tesla's past growth rates and incorporation of current and especially future competition on the market. These results will then be compared to the inner growth of the company, the reinvestment rate, to ensure inner consistency in the assumptions as according to Damodaran "growth ultimately comes from inner workings of the firm" (Damodaran, 2008 (II), p.27).

Growth can be determined through:

Earnings = ROI * Investments

With the growth rate being:

$$g = \Delta E/E_{t-1} = ROI_{New,t} * (\Delta I/E_{t-1}) + (ROI_{Existing,t} - ROI_{Existing,t-1}) / ROI_{Existing,t-1}$$

Efficiency growth is displayed through ROI (existing,t) – ROI (existing,t-1) and an increase in ROI will generate additional earnings growth.

4.1.3 Risk and discount rate

The input for risk and discount rates for a growth company are identical to these of mature businesses. The general formula used for discounting future cash flows and the way of computing this, customized on the example of Tesla, is illustrated below.

4.1.3.1 Weighted average cost of capital (WACC)

The WACC is used as the appropriate discount rate for discounting back future FCFFs as it includes weights and costs of equity, capital and preferred stocks. Therefore the formula for the weighted average cost of capital is the following:

$$\text{WACC} = \frac{E}{(D+E+PS)} * \text{Cost of Equity} + \frac{D}{(D+E+PS)} * \text{Cost of Debt} + \frac{PS}{(D+E+PS)} * \text{Cost of Preferred Stock}$$

With the cost of equity being the rate that investors require on their investment, the cost of debt being the costs for which company can borrow funds and the cost of preferred stock sharing features of both. The cost of preferred stock can be calculated as preferred dividend per share divided by the market price per preferred share, which assumes that dividends do not change over time and they don't have any additional features like convertibility (like options do for example).

It is visible in the formula of the WACC that as soon as the weights of equity, debt and preferred stock change over time, the WACC will change accordingly, which is also the case for Tesla. Consequently, the cost of capital of a growth firm should never be a static number. Instead, it has to be adjusted annually according to the estimated profile of the company. These weights of equity, debt and preferred stock are based on market values and not on book values to appropriately reflect the current capital structure and refinancing abilities of the company.

4.1.3.2 Cost of debt

The cost of debt represents the additional default risk and their associated default spread companies face additional to the underlying risk-free rate. Therefore the formula of computing the cost of debt can be described as:

Cost of Debt = Risk-free Rate + Default Spread

Tesla, publicly traded company, receives credit ratings from major rating companies such as Moody's or Fitch. Damodaran provides a table, where these credit ratings can be converted into default spreads of the companies. This table will be used to estimate the default spread of Tesla, which will be added to the

underlying risk-free rate. Damodaran recommends using market values of debt to properly reflect the financial situation of the company. Therefore the book value of debt will be converted to the market value of debt by treating "the entire debt on the books as one coupon bond, with a coupon set equal to the interest expenses on all the debt and the maturity set equal to the face-value weighted average maturity of the debt, and then to value this coupon bond at the current cost of debt for the company" (Damodaran, 2012, p.219). It is important to mention that the tax shield in the after-tax cost of debt calculation depends on positive earnings to offset interest expenses (Damodaran, 2010). Due to Tesla's operating losses carrying forwards there are no tax benefits from interest expenses in the first years, which has to be considered in the after-tax cost of debt in the valuation of Tesla turning the after tax cost of debt into the cost of debt before tax until the company's net operating losses carried forwards are depleted.

4.1.3.3 Cost of equity

The cost of equity will be computed by applying the capital asset pricing model (CAPM). This approach is mostly used for valuation purposes and it can be described as the following:

Cost of Equity (r_e) = Risk-free Rate + Levered Beta * Market Risk Premium

Beta calculation

To compute the cost of equity the beta for the company needs to be determined. Beta describes "the risk that an investment adds to a market portfolio" (Damodaran, 2012, p.183).

Two different methods will be applied in this work for different purposes.

The betas based on historical market data are received by running a regression of stock returns on the investment against a market index, in this valuation case the S&P 500. Bloomberg provides results for the regression model in the case of Tesla and its peer companies.

This method is only used for peer companies and not for Tesla as there are several disadvantages of this method. Firstly, Bloomberg uses price appreciation in the stock and the market index to compute the betas and it also does not incorporate dividends. Especially in the case of Tesla, as it is not paying out any dividends, it can screw the interpretation. Secondly, if the regression model shows a high standard error of beta, the actual beta can differ widely within this range to both sides. Therefore this method will not be applied for Tesla. Nevertheless, to compute betas of industry peer companies, the historical market beta approach is appropriate.

The use of bottom-up betas is a combination out of historical market betas of peer companies in the company's industries of operation and fundamental betas. The bottom-up approach states that "the beta for

a firm is a weighted average of the betas of all the different businesses it is in" (Damodaran, 2012, p. 197). These five steps are provided below:

1. Identify the business or businesses the firm operates in.
2. Find other publicly traded firms in each business and obtain regression beta.
3. Calculate average or median regression beta of these peer companies in each sector and unlever these betas to receive the average unlevered beta for the businesses by using the following formula:

$$\text{Unlevered Beta}_{\text{business}} = \text{Beta}_{\text{comparable firms}} / [1 + (1 - t) * (\text{D/E Ratio}_{\text{comparable firms}})]$$

4. Use weights of unlevered betas of the underlying businesses of operation and ensure consistency with weights used in the computation of the operating margin.

$$\text{Unlevered Beta}_{\text{firm}} = \sum(\text{Unlevered Beta}_{j} * \text{Value Weight}_{j})$$

5. Compute Market values of debt and equity of the firm for the valuation date to receive D/E ratio.

However, the discount rate for growth companies shifts over time due to changes in their risk profile. This is considered in bottom-up betas as it reflects "actual changes in a firm's business mix and expected changes in the future" (Damodaran, 2012, p. 198).

To account for the change in the risk profile three general rules should be followed:

- Growth firms high costs of debt and equity when highest revenue growth and declining cost of debt and equity when revenue growth moderates and profitability margins improve over time.
- Earnings usually improve over time and growth drops, this leads to generation of higher cash flows than needed for reinvestment. Firms then can use these additional cash flows to pay dividends or repay debt. Other firms take additional debt to use the effect of the tax shield, which usually cause debt ratios to increase over time which has to be considered in the calculation of the discount rates.
- Betas also change heavily over time → use of betas obtained by publicly traded comparable companies with similar risk, growth and cash flow characteristics and also industry averages
  → bottom-up betas.

Risk-free rate

The risk free rate relates to the assumption that actual returns are equal to the expected returns, implying a variance of zero. The rate to be risk-free requires no default risk in the security, which automatically excludes securities issued by companies as these can never be defined default free, as well as no

reinvestment risk, implying that in a five year time horizon the risk free rate must equal the default free government five year zero coupon bond. Furthermore to be precisely with the discount factors, the one-year risk-free rate has to be taken to discount cash flows from year one and so on. Nevertheless, in terms of valuation one risk-free rate is used for all cash flows with the same duration as the cash flows in the analysis.

Furthermore it is vital to differentiate between nominal risk-free rates and real risk-free rates. As long as these assumptions are consistent with other assumptions in the valuation model, both models should yield the same result. Real rates should only be used in countries with no stable inflation. For the purpose of this valuation nominal interest rates are chosen to ensure consistency with further assumptions in nominal terms as the whole valuation of Tesla is conducted in nominal terms.

Market Risk Premium (MRP)

The market risk premium describes the spread of the expected market return over the risk-free rate. The formula is the following:

MRP = Expected Return on the Market – Risk-free Rate

Tesla is seen as a multinational, global company, with sales in almost all parts of the world. This circumstance requires considering the MRPs in Tesla's most active markets, to properly reflect the total market risk premium of the company. The data of expected returns in the market are retrieved from Bloomberg as well as the risk-free rates of the underlying markets.

4.1.4 Terminal value

In case of growth companies and especially in the case of Tesla, the terminal value accounts for a large portion of the total firm value as "it comprises a much larger portion of the firm's current value than is the case with a mature firm" (Damodaran, 2010, p. 285).

Three recommendations should be followed to determine the terminal value of growth companies:

1. Do not wait too long to put a firm into stable growth. High growth periods longer than ten years are in general hard to defend, because usually companies are not able to achieve this. Also in the case of Tesla and the drastic change in the car market, high growth is sustained over a relatively long period, with a high growth period of ten years before reaching stable growth.
2. Stable growth → characteristics of stable growth firm: Consequences can comprise lower costs of debt and equity and a higher portion of debt.
3. ROC in stable growth: Either equal to cost of capital or preservation of some company-specific flexibility with a maximum difference of ROC and cost of capital o 4% - 5%.

For the valuation of Tesla two approaches of terminal value calculation are used:

1. Liquidation value in case of finite life assumption: It is assumed that with a specific probability, which will be determined later on in that work, the company will stop operating at some point in the future and sell its accumulated assets to the highest bidder. In order to compute the liquidation value of Tesla, future expected cash flows generated by the company's assets are estimated and discounted back to the present.
2. Stable growth model in case of infinite life assumption: assumption that "cash flows, beyond the terminal year, will grow at a constant rate forever" (Damodaran, 2012, p. 306). The approach of stable growth model will also be assigned with a defined probability.

It is also important to ensure consistency with the reinvestment rate of the company in perpetuity which is needed to retain the perpetuity growth rate.

Reinvestment Rate in stable Growth = $\frac{\text{Stable Growth Rate}}{\text{ROC}_n}$

With ROC_n being the return on capital that the firm can sustain in stable growth (Damodaran, 2012).

4.2 Tesla – a growth company

Tesla is considered and treated as a growth company in this work due to the following reasons:

- Future earnings growth higher than market growth.
- High multiples of earnings, revenues and book value (compared to mature companies).
- IPO of Tesla → left earliest stage of life cycle.
- Dynamic financials: numbers in financial statements are in a state of flux (Damodaran, 2010).
- Market value > book value, because market value incorporates value of growth assets, which book value does not.
- In general low portion of debt relative to market and intrinsic value compared to mature firms, as companies do not have the cash flows from existing assets to manage more debt.
- Short and shifting market history.

Tesla gets a significant portion of its value from growth assets. In addition, to categorize Tesla as a growth company excess returns out of these growth assets have to be received. Excess returns appear if ROC > cost of capital.

4.2.1 Key issues for valuation of Tesla Inc.

In order to conduct a technically correct valuation of Tesla Inc. main key issues are identified which during the valuation a strong spotlight will be put on to avoid biases in the valuation. Furthermore solutions are presented to solve these issues.

Key problems in valuation of Tesla can be identified as the following:

- Short and volatile operating histories;
- Uncertainty regarding future growth → detailed analysis of market and sector and orientation on growth of closest competitors;
- Risk profile changes → yearly adjustment of discount rates.

According to Damodaran the key issues/problems related to a growth company can be enhanced to difficulties related to the four main inputs of valuation which also have to be considered for the valuation of Tesla. Besides listing the listing the issues, also solutions are presented to solve these problems.

Issues related to existing assets:

- Poorly measured earnings: Existing assets only small part of overall value;
- Shifting profitability: Margins and profitability measures change significantly over time in opposite to mature companies where they are usually only moving in a specific window → orientation of profitability measures of mature companies which are considered as close competitors and with the rates being reached over time.

Issues related to growth assets:

- Impact of scaling effect: It has to be determined how strong is growth rate affected by changing size of the company over time, because in general for bigger companies it is more difficult to sustain high growth rates, which leads to lower growth rate (especially revenues) over time;
- Higher competition: Can result in lower profitability and value for growth as companies need to stay competitive → analysis of competition and incorporating in measures;
- Macroeconomic impacts: smaller firms more revealed to macroeconomic impacts as products very often in niches, therefore substitution of these products in downturns.

Issues related to risk / discount rates:

- Variance of discount rate for assets-in-place and growth assets: The separation and estimation of the discount rates based on historical information can be difficult;
- (Volatile) Market value versus book value ratios: Weights for debt and equity are derived from market values, even though they can be highly volatile for growth companies as equity value can change quickly → high volatility in stock price;
- Changing risk of company over time: If company becomes bigger, existing assets should become bigger portion of value and earning should become more stable, both should be incorporated in risk measures → higher discount rates in the beginning and decreasing rates over time toward mature company levels.

Issues related to terminal value:

- Time point when company will become stable growth firm & characteristics in that phase.
- TV big or almost entire proportion of value: As low cash flows in first periods, TV proportion will become bigger → special spotlight on TV assumptions as they will have high impact on valuation, also showing sensitivity of assumptions on value of Tesla.
- More uncertainty about terminal value assumptions → sensitivity analysis.

Issues related to value of equity per share:

- Cash balances and cash burn ratio: Due to the high need of additional capital and cash, cash balances and cash burn ratios can vary strongly over time.
- Use of convertible debt: Use of convertible bonds – low interest payments in return for providing options to the lenders, "because only debt should be subtracted to get to equity values, we should break convertible debt into debt and equity components, with equity options going into the latter" (Damodaran, 2010, p. 270).

One of the most important questions related to revenue growth is how fast will the growth rate decline given increasing size of the company in the future. To answer this question as precisely as possible it is important to look at the size of the overall market, the competition within the market and the quality of Tesla's products and management. Therefore the practical part of this thesis will start by analyzing current and future markets of operations of Tesla, followed by determining competition within these markets. Afterwards the business model, Tesla's competitive advantages and the sustainability of the business model are analyzed which serves as the framework for the forecast of Tesla's future revenues, the main driver of future cash flows. To validate the assumptions, these forecasts are compared to past revenue growth rates and the growth rates in the markets of operation.

4.3 Adjustments of financial statements

In order to draw correct conclusions and analyze Tesla correctly, adjustments to the Financial Statements have to be performed. These steps have to be undertaken before any calculations are done.

4.3.1 Normalization of financial statements

Normalization of financial statements refers to the practice to "adjust reported financial data for non-recurring items, a process known as scrubbing or sanitizing the financials" (Rosenbaum & Pearl, 2013, p. 44). One-time charges have to be added back and one-time gains have to be eliminated not conclude misleading financial ratios and margins and ensure comparability among peer companies and industries. Furthermore Damodaran recommends to average gains or losses that appear in a sequel of a few years over the amount of years. In the case of Tesla, operating profit will be adjusted for any non-recurring items are reported in the financial statements to ensure a correct starting operating profit margin.

4.3.2 Fully diluted shares outstanding

"A company's fully diluted shares are calculated by adding the number of shares represented by its in-the-money options, warrants, and convertible securities to its basic shares outstanding" (Rosenbaum & Pearl, 2013, p. 31). All the information regarding dilution of shares and the company's current amount of basic shares can be retrieved from the company's financial statements.

4.3.2.1 Treasury stock method (TSM)

The Treasury Stock Method is applied for the company's in-the-money options and warrants. The underlying logic is that all in-the-money options and warrants are exercised at their weighted average exercise price and that the option proceeds are used to repurchase outstanding shares at the current share price. The TSM accounts only for in-the-money call-options meaning that the strike price is below the current share price of the underlying company. Therefore a lower amount of shares can be repurchased than additional shares outstanding from the exercise of these options which results in "a net issuance of shares, which is dilutive" (Rosenbaum & Pearl, 2013, p. 31).

4.3.2.2 If-Converted method

For convertible bonds and equity-linked securities the if-converted method is used to calculate additional incremental shares. These options also have to be in-the-money, meaning the conversion price has to be below the current share price. The issuance information of convertible bonds and equity-linked securities can be retrieved from Tesla's financial statements.

4.3.3 Operating lease adjustment

Before financial ratios and forecasts can be applied, operating leases have to be classified as capital leases according to the working paper "Dealing with Operating Leases in Valuation" by Damodaran. This is due to the reason that operating expenses do not include any financing expenses, which is the case according to Damodaran for operational leases as he argues that "they really represent financing expenses" (Damodaran, 2008 (I), p. 2).

Capital leases are treated the same way as purchased assets, applying depreciation and an "imputed interest payment on the lease as tax deductions rather than the lease payment itself" (Damodaran, 2008 (I), p. 6). The interest payment is then treated as a debt payment which will be divided into interest payment and principal repayment. Capital leases are shown on the balance sheet as an asset with a corresponding liability which reflects the present value of the expected lease payments.

This is important as both classifications, operating and capital leases, lead to different figures in the valuation as they affect operating income, capital, profitability and cash flow measures. Table 2, which was provided by Damodaran, describes the influences on different ratios. Main influences comprise that operating leases show lower operating and net income, debt and capital will be understated and return on equity and capital usually will be higher compared to capital leases.

Table 2: Effects of operating and capital leases on different return measures

Ratio	Effect of Operating Lease	Effect of Capitalized Lease
Return on Capital	Decrease of EBIT through lease expense Capital does not reflect leases ROC higher	Decrease of EBIT through depreciation Capital increase through PV of operating lease ROC lower
Return on Equity	Net income lowered by after-tax lease expense BV of equity unaffected ROE effect depends on whether lease expense > (imputed interest + depreciation)	Net income lowered by after-tax interest expense & depreciation BV of equity unaffected ROE effect depends on whether lease expense > (imputed interest + depreciation)
Interest Coverage	EBIT (1-t) decreases Interest exp. Unaffected	EBIT (1-t) decreases Interest exp. Increases
Debt Ratio	Debt unaffected Debt Ratio is lower	Debt increases (to account for capital lease) Debt ratio is higher

Source: Damodaran, 2008 (I), p. 9.

According to Damodaran several steps have to be performed to adjust for operating leases:

1. The capital adjustment: Discounting of future lease commitments back to the present by the pre-tax cost of debt being the firm's cost of unsecured debt → pre-tax to ensure consistency and present value of capital lease commitments is treated as debt.
2. The income adjustment: If operating leases are fixed commitments for the future → adjustment of pre-tax operating income and net income → increase of operating income due to reclassification of operating leases → operating income will be increased by imputed interest expense on the capitalized debt.
3. The profitability adjustment: most directly affected is return on capital with different effects depending on if Unadjusted pre-tax ROC > Pre-tax Cost of Debt → ROC will decrease;
   Unadjusted pre-tax ROC < Pre-tax Cost of Debt → ROC will increase.
4. The free cash flow adjustment: change in net capital expenditures (CAPEX) which is determined by growth in present value of operating lease commitments over time → as operating margin is used to compute FCFF in the case of Tesla, this adjustment is not needed.
5. The effect on discounted cash flow value: affects operating income, CAPEX and cost of capital and consequently also FCFF → debt value deducted after calculation of firm value to arrive at the equity value also has to include the adjusted debt from operational leases.

4.3.4 Research and development (R&D) adjustment

Another adjustment of the financial statements refers to R&D expenses. Damodaran states that no matter about the uncertainty of future benefits of R&D expenses, they should be capitalized (Damodaran, 2007 (I)). This argument refers to the fact that R&D expenses create benefits over multiple periods, which is the characteristic of long-term assets on the balance sheet. The steps of reclassifying R&D expenses are:

1. Remove R&D expenses from operating expenses and show it as CAPEX.
2. Creation of asset through CAPEX → R&D expense has to be cumulated over time.
3. Amortization of asset over amortizable life → not tax-deductible, but affects operating income.

There are different calculations that come along with this reclassification. The first step is to estimate the so called amortizable life of these assets. Therefore an estimation about the conversion period of R&D expenses into commercial products is needed which will be used as the period of amortization.

The next step is to collect data about R&D expenses during the amortizable life period and then applying the following formula to receive the value of the research asset:

Value of the Research Asset = $\sum_{t=-(n-1)}^{t=0} R\&D_t \frac{(n+t)}{n}$

With the afterwards adjustments being:

Adjusted Book Value of Equity = Book Value of Equity + Value of Research Asset
Adjusted Operating Income = Operating Income + R&D – Amortization of Research Asset
Adjusted Net Income = Net Income + R&D – Amortization of Research Asset

Note: Expenditures of the current year will not be amortized as it is assumed that these expenditures occurred during the time period of the analysis.

4.3.5 Operating margin convergence

In general operating margin describes the ratio of operating profits to same year's revenues. However, operating profit margins can be negative or too low relative to the sustainable long-term margin due to high up-front fixed costs with later payoff, "mingling of expenses incurred to generate growth with operating expenses" (Damodaran, 2010, p. 283) as selling expenses in growth firms are often addressed toward future growth rather than current sales, which will be changing over time and resulting in higher margins, and third a deviation between revenues generated and incurred expenses, as expenses today planned to generate revenue in future years will already decrease margins today.

The solution, suggested by Damodaran, is to look at both "the average operating margin for the industry in which the firm operates and the margins commanded by larger, more stable firms in that industry" (Damodaran, 2010, p. 284) to compute the basis for the free cash flow calculation. Damodaran recommends using the target operating margin to be reached by the company close to its terminal year instead of forecasting depreciation, capital expenditures and working capital separately. Especially for growth companies like Tesla, forecasting these figures is an issue of impossibility as these figures and their revenue margins can vary strongly within the years depending on future plans of the company. Therefore it is more appropriate to let the company converge to its estimated target operating profit margin over time.

This target operating margin is determined by Tesla's closest competitors' operating profit margins in the sectors the company is operating in. Furthermore a premium is added for the advantage of vertical integration and future economies of scale, especially in the cost reduction of batteries, by Tesla which results in choosing higher quantiles in the single sectors of operations according to the strength of Tesla's competitive advantages.

5 Valuation – practical perspective

The practical part of the thesis starts by analyzing the business model, which is followed by a detailed overview and analysis of the car market, electric vehicles market and battery electric vehicle market. An analysis of sales units by car manufacturers and companies is conducted to identify Tesla's closest competitors which are then described according to their current and future targets in the electric vehicle market. These analyses provide the framework for assumptions about Tesla's future performance. Additionally, future sales units in the total electric vehicle market and battery electric vehicle market are estimated to provide reasonability of estimated sales units of Tesla, due to comparison of total sales numbers, annual growth rates and sales unit margins to Tesla's competitors.

5.1Business model

"It is the entire organization together as one thing, working together to deliver value" (Morris, 2013, p. 13). This is a statement of the article "Business Model Warfare" by Langdon Morris which implies that to understand the business model and key value drivers, the entire organization has to be described and analyzed. As a starting point for the analysis of Tesla's business model serves Tesla's annual report of 2017. According to the report, the main business model is to "design, develop, manufacture and sell high-performance fully electric vehicles, and energy generation and storage systems, and also install and maintain such systems and sell solar electricity" (Tesla Inc., 2018, p. 68). Therefore the business segments, which are also enforced by the split of revenues, can be divided into the following parts:

- All-electric car segment – selling and leasing – 82% of total revenues 2017;
- Energy generation and storage – battery systems and solar power generation and storage – 9,5% of total revenues 2017;
- Service and other – 8,5% of total revenues 2017.

The car segment and the energy segment both comprise high-end technology, such as autonomous driving equipment and the handling of peak demand and distribution in an electricity network. Therefore Tesla is also considered to be partially a tech-company, with the consequence of incorporating these assumptions into the valuation later on.

5.1.1 Sales channel

Tesla's sales channel differs significantly from other car manufacturers as Tesla is selling its vehicles through its own international network of stores and galleries. However, the main sales channel of placing orders is via the Internet, by clients customizing and ordering their vehicle(s) on Tesla's official homepage. Besides the disposal of new cars Tesla also features the possibility to sell used Tesla and non-Tesla cars back to the company which are then either remarketed or incorporated as a reduction of the

purchase price for a new Tesla vehicle. This includes also Tesla vehicles through lease returns and other sources. The service is recognized in the income statement under revenues out of services and other.

5.2 Current product portfolio

The current product portfolio comprises products in the car segment as well as the energy generation and storage segment.

5.2.1 Car segment – current product portfolio

Firstly, Tesla's product portfolio in the car segment is described. The current product portfolio comprises three full battery electric vehicles:

1. Model S
2. Model X
3. Model 3

All electric vehicles (EV) of Tesla include technologies such as "mobile computing, sensing, displays, and connectivity" (Tesla Inc., 2018, p. 3).

5.2.1.1 Model S – 2012 – available

The Model S was introduced in 2012 with start of delivery in June 2012. The listed vehicle versions of the Model S are illustrated in table 3.

Table 3: Tesla Model S specifications

Model S (Sedan)	Battery (kWh)	Acceleration (0-60 mph)	Range (charge)	Drive	Charging (with referral)	Price (in $)
75D	75	4,2 sec	259 miles	All-Wheel	Free & Unlimited Supercharging	74.500
100D	100	4,1 sec	335 miles	All-Wheel	Free & Unlimited Supercharging	94.000
P100D	100	2,5 sec	315 miles	All-Wheel	Free & Unlimited Supercharging	135.000

Some of the most important Model S features are: driver display + 17" touchscreen, Wi-Fi and LTE internet connectivity, keyless entry, back-up camera, plus diverse premium upgrades, seven signature colors, free over-the-air software updates.

Signature features of single models comprise:

- Model S 100D: longest range EV sedan worldwide;
- Model S P100D: Ludicrous speed upgrade included → fastest accelerating production vehicle worldwide + option package already included.

Furthermore there are several additional options available for Model S (except Model S P100D as already included):

Premium upgrade package: $5.000

- Medical-grade HEPA air filtration system;
- Custom audio system.

Enhanced autopilot: $5.000

- Going from one to four cameras for greater accuracy;
- 12 ultrasonic sonar sensors provide 360 degree coverage with twice the range of previous version;
- Keep within a lane, automatically change of lanes, transition from one freeway to another, self-park when near a parking spot;
- $6.000 if activation after purchase.

Full self-driving capability: $3.000

- Doubles number of cameras to eight;
- Full self-driving in almost all circumstances, twice as good as human driver;
- Short and long distance trips without any action;
- Park-seek mode;
- $4.000 if activation after purchase.

5.2.1.2 Model X – 2015 – available

The delivery of the second model, the Model X, started approximately three years later in September 2015. It belongs to the group of sport utility vehicles (SUV) and it offers seats for up to seven people. Tesla advertises the car as the "longest range all-electric production sport utility vehicle in the world" (Tesla Inc., 2018, P. 2) with a listed minimum range of 237 miles. Both Model S and Model X are built with a lightweight aluminum body.

Table 4 describes the most significant features of available Tesla's Model X:

Table 4: Tesla Model X specifications

Model X (SUV)	Battery (kWh)	Acceleration (0-60 mph)	Range (charge)	Drive	Charging (with referral)	Price (in $)
75D	75	4,9 sec	237 miles	All-Wheel	Free & Unlimited Supercharging	79.500
100D	100	4,7 sec	295 miles	All-Wheel	Free & Unlimited Supercharging	96.000
P100D	100	2,9 sec	289 miles	All-Wheel	Free & Unlimited Supercharging	140.000

Model X Features: driver display + 17" touchscreen, Wi-Fi and LTE internet connectivity, keyless entry, back-up camera, plus diverse premium upgrades.

Additional features of Model X compared to Model S: four latch attachments for child seat installations in 6-seat and 7-seat configurations, rear door child safety locks, 2" receiver for hitch-mounted bike and ski carriers, largest glass panoramic windshield in production, falcon wing doors.

Additional options available for Model X:

- Enhanced autopilot (same as for Model S): $5.000;
- Full self-driving capability (possible also with center console and same as for Model S): $3.000;
- Six seat interior: $6.000;
- Seven seat interior: $3.000 (after purchase of six seat interior).

5.2.1.3 Model 3 – 2017 – available with delay up to 12 month

Whereas the Model S and Model X are vehicles for the upper-segments in the car market, the Model 3 of represents Tesla's first sedan for the mass market. Therefore the expected production rates of Model 3 will be significantly higher than these of the Model S and Model X. The delivery start was in July 2017 with a purchase price starting at $35.000, which can increase up to $60,000 respectively $70.000 by adding all premium options currently available. The acceleration of the Model 3 is comparable to these of the BMW 3 series and the Mercedes C Class, two of Tesla's closest competitors in the car market.

Table 5 describes key specifications of Model 3's standard and long-range versions.

Table 5: Tesla Model 3 specifications

Model 3 (SUV)	Battery (kWh)	Acceleration (0-60 mph)	Range (charge)	Drive	Charging (with referral)	Price (in $)
Model 3 Standard	50 – 55	5,6 sec Max. Speed: 130 mph	220 miles	-	Free & Unlimited Supercharging	35.000
Model 3 Long Range	75	5,1 sec Max Speed: 140 mph	310 miles	-	Free & Unlimited Supercharging	45.000

Model 3 standard features: 15" touchscreen, chassis mix of materials (lower costs compared to aluminum chassis), full self-driving hardware, over-the-air software updates, full LED exterior lighting, dual zone climate control, textile seating, seven cameras, power-adjustable side mirrors, keyless entry.

Model 3 long range additional features: rear wheel drive (beginning configuration), premium upgrades, three customization options: wheel size, exterior color, autopilot features.

Options available for Model 3 according to electrek.com:

- Long range battery: $9.000;
- Paint (all colors but black): $1.000;
- Wheels 18" aero or 19" sport: $1.500;
- Upgrade on interior comprising heated seating, premium audio system, tinted glass roof and more: $5.500;
- Enhanced autopilot (like Model S and Model X): $5.000;
- Full self-driving capability: $3.000.

By the beginning of 2018, Tesla reported 455.000 reservations for the Model 3 with a required deposit of $1.000 per car.

5.2.2 Car segment – Tesla's future vehicle introductions

Besides the three models, which are already available, Tesla also presented its first Semi-Truck and a new version of the Tesla Roadster, both during the annual motor show in November 2017. Furthermore Tesla already accepts reservations for both models for a reservation payment of $5.000 plus additional $245.000 within ten days for the founder series, $5.000 plus additional $45.000 for the regular new version of the roadster and a $20.000 deposit for the Semi-Truck. This is important to mention, as these reservations are already included in Tesla's financial statements. In April 2017 Elon Musk also announced that a Tesla

Pick-Up is planned to be introduced within the next 18 to 24 month meaning between October 2018 and April 2019. However, no further information is currently available.

5.2.2.1 Roadster – 2020

The base model of the new version of the Roadster will not be available until 2020 and the purchase price will start at $200.000 with a special "Founder's Series" starting at $250.000.

The acceleration will make it the fastest consumer car on the planet (Shaban, 2017) comprising three motors.

Table 6: Tesla Roadster specifications

Roadster (high-end)	Battery (kWh)	Acceleration (0-60 mph)	Range (charge)	Drive	Charging (with referral)	Price (in $)
Base Specification	200	1,9 sec	620 miles	All-Wheel	Free & Unlimited Supercharging	200.000
Founder Series	200	1,9 sec	620 miles	All-Wheel	Free & Unlimited Supercharging	250.000

Additional specifications:

- Acceleration: 0-100 mph in 4,2 seconds;
- Features: driver display + 17" touchscreen, Wi-Fi and LTE internet connectivity, keyless entry, back-up camera, plus diverse premium upgrades, 4 seater, glass roof;
- Additional features to Model S: Same as Model X 75D;
- Base price: $200.000 – base reservation: $50.000 – Founders series price & reservation: $250.000.

Options:

- Battery upgrade 3.0: $29.000;
- Deposit: $5.000;
- Total range increase of 35%.

5.2.2.2 Semi-Truck – 2019/2020

By the end of 2017 the Tesla Semi-Truck reached a reservation volume of more than 200 vehicles. Buyers include companies like DHL, J B Hunt Transport Services Inc. or Wal-Mart. This fact illustrates that also in the transportation sector there is a high acceptance for Trucks produced and sold by Tesla which implies that Tesla has high chances to also be successful in this sector in the future. Both versions of the truck include a one million mile guarantee on its powertrain. An important feature of Tesla's Semi-Truck and a standalone characteristic is the ability to accelerate uphill as the first truck in the world. The cost comparison made by Tesla quotes per mile costs of operating of $1.26 for the Semi Truck compared to

$1.51 per mile costs for a diesel truck. The assumptions for this calculation comprise a diesel price of $2.50 per gallon versus 7 cents/kWh for electricity and travelling at maximum load at an average speed of 60mph. These figures correspond to current prevailing market conditions. If these numbers prove to be correct, Tesla will be able to also compete in the transportation and truck. No current information are available on the Tesla homepage, therefore information were retrieved from electrek.com, which are illustrated in table 7.

Table 7: Tesla Semi-Truck specifications

Semi-Truck (high-end)	Battery (kWh)	Acceleration (0-60 mph)	Range (charge)	Drive	Charging (with referral)	Price (in $)
Smaller range	200 (estimates)	5,0 sec	300 miles	All-Wheel	Free & Unlimited Supercharging	150.000
Longer range	200 / 500 (estimates)	5,0 sec	500 miles	All-Wheel	Free & Unlimited Supercharging	180.000

According to estimates of Bloomberg New Energy Finance the battery pack of the Semi-Truck should even reach capacities of 600 kWh – 1000 kWh to provide the promised power and range. This is approximately ten times more than the biggest battery in the Model S and with the current state of battery technology this pack would weight around five tons and cost more than $100.000. These are also reasons that the assumption about a future introduction date is shifted backwards in this paperwork from 2020 stated by Tesla to at least 2022.

5.2.2.3 Model Y – 2019/2020

Tesla also revealed plans for the introduction of the Model Y, which is meant to be a smaller version of the Model X. By this step Tesla wants to assure to meet the growing demand in the segment of smaller SUVs. The Model Y is described as a compact crossover with a noticeable lack of side mirrors (Siu & Prince, 2017). The launch of Model Y is planned for late 2019 to 2020. Currently there is no further information available on the official Tesla homepage. To mention is that the Model Y cannot be produced on the same line as the Model 3 which will require a new factory including setting up the production line which will thus shift the assumed roll out to late 2021 by the earliest.

To sum it up according to plans of Tesla, by 2020 the product portfolio could comprise the following models:

- Model S: premium market;
- Model X: SUV market;
- Model 3: mass market;
- Model Y: crossover between SUV and sedan;
- Roadster: high-end sports car;
- Pick-Up: SUV market and transportation market;
- Truck: transportation market.

This product mix would cover all segments of the car and transportation market, with the only exception being the motorcycle sector. However, the question is how probable are the promises of Tesla and Musk regarding their introduction and production targets as in the past announced targets were met rather rarely. This fact is also illustrated by the example of the Model 3 production problems.

5.2.3 Model 3 production problems

CEO Elon Musk constantly communicates that Tesla is still considered a start-up company without previous experience in the mass production of vehicles. After the roll-out of the first 30 Model 3s on July 28th 2017, the production problems of Tesla became more and more visible. Tesla announced a production target of 5.000 vehicles per week by the end of 2017 and 10.000 vehicles per week by the end of 2018 for its Model 3. However, especially due to struggles by engineers with the automation of the manufacturing process, the production target was already adjusted several times to a current target capacity of 2,500 vehicles per week by the end of Q1 2018 and 5,000 vehicles per week by the end of Q2 2018 after delivering only 1.550 units in Q4 2017 instead of 10.000. Therefore according to current state, the discrepancy between announcement and reality is as big as half a year delay for the basic models. The high performance models will be delayed for six to nine months in order to keep the rollout simple.

Thus, one of the biggest risks for Tesla lies in losing the trust of its clients who could decide to switch to other manufacturers after waiting more than one year for their cars. This could lead to huge losses in its image and afterwards in revenues, especially as Model 3 is designed to open the door for Tesla into the mass market. Therefore one of the most important challenges in the future and a pathway for the future development of Tesla will be how the company will be able to handle the problems in the production of the Model 3 and future car introductions.

5.2.4 Assumptions future product introductions

The assumed point in time for the introduction of Tesla's future models is illustrated in table 8 including a comparison to its announced introduction and assumptions about their starting average selling prices. These assumptions also incorporate the experience of delayed introduction of the Model 3 as the delay of Model 3 will also influence and shift backwards the production of future vehicles as firstly current problems related to the ramp-up of the Model 3 have to be solved, before the company is able to put more effort into the production of future vehicles. Past introductions were conducted in a time span of almost three years for each new model if assuming that real production of Model 3 started in 2018. This frequency is assumed to sustain for the introduction of the Model Y with fastening afterwards, as main investments into enhancements of production facilities, automation processes and efficiency improvements come into effect. Consequently, the following conclusions were made:

Table 8: Announced and assumed introduction and assumed average selling price of future models

Model	Announced Introduction	Assumed Introduction	Average Selling Price ($)
Model Y	2019	2021	53.000
Semi-Truck	2019-2020	2022	175.000
Pick-Up	Oct. 2018 – Apr. 2019	Not before 2027	-
Roadster	2020	2024	205.000

5.2.5 Charger network and charging policy

Another big challenge in the future, which is related to the introduction of EV, and which is already included in the business model of Tesla, is charging these vehicles in the most convenient way. In general the process of charging an electric vehicle requires an on-board charger module, a communication controller and a charging cord. The charger module is responsible for charging the battery pack by converting AC to DC with high efficiency. Additionally, various high-voltage cables are required to connect the modules with each other and with the battery (Q-Series: UBS Evidence Lab, 2017).

Tesla is providing own home charging stations to charge vehicles overnight, also in combination with their Solar Roof and battery technologies. The company is also providing and further developing its own network of so called superchargers and destination chargers in North America, Europe and Asia. This is an important note as Tesla's goal is not to depend on external providers. However, in case there is no available Tesla charger around, charging is also possible at a variety of public charging stations around the world either with or without the use of adapters. Furthermore additional charging options are available through cooperation with hotels, resorts, shopping centers and parks.

As of January 2018, the supercharger network comprised 1.130 supercharger stations worldwide, with the main percentage being in Europe and America. Nevertheless, China is gaining fast by having 146 superchargers compared to 447 superchargers in the U.S. superchargers stations offer between six to

twenty Superchargers. The use is either free or requires a small fee. These electricity providers are mainly equipped with Tesla's own solar and energy storage systems.

Even though Tesla currently increased its charging fees in the U.S. between 20%-100%, the company also announced that the price increases are just related to cover network maintenance and development costs as Tesla wants to increase the number of charging stations from 1.180 to 9.000 and to 18.000 Superchargers by the end of 2018 (Lambert, 2018 (I)). According to the announcement these payments will never become a center of profit for Tesla and furthermore it is not considered heavily influencing Tesla customers as most of them are charging their vehicles at home.

5.3 Energy generation and storage systems

5.3.1 Battery systems

Besides the production of vehicles, Tesla also fabricates its own batteries, power electronics as well as integrated systems. In the end of 2016 Tesla started its production and delivery of the latest generation energy storage products, Powerwall 2 and Powerpack 2. These products with its main features are described below in table 9.

Table 9: Tesla battery systems specifications

Name	Product	Battery (kWh)	Features	Use	Reservation ($)	Price ($)
Powerwall	Lithium-Ion Battery	14 kWh	Rechargable, 100% Self-powered (in combination with solar panels), 7+ days continuous power	Private& Small Commercial	500	5.900 + 700 (Hardware)
Powerpack	Lithium-Ion Battery	210 kWh packs & 50kVa (at 480V) inverters	Packs &Inverters can be further combined to create MWh/GWh installations	Commercial Industry & Utility	-	On Request

Tesla recommends the use for "commercial and industrial customers for peak shaving, load shifting, self-consumption of solar generation and demand response, as well as to provide backup power during grid outages" (Tesla Inc., 2018, p. 3). Powerwall works in that way that in case of an outage, it can disconnect from the grid, and automatically restore power to homes in just a fraction of a second.

Like Tesla cars these energy storage products can obtain over-the-air firmware as well as software updates to ensure that the costumer can receive additional features over time.

5.3.2 Solar energy systems

Also the Solar Energy segment unveiled a new product in 2016, the Solar Roof, which is available since then, besides Tesla's offer of solar panels. According to Tesla's annual report 2017 it integrates solar energy production with aesthetically pleasing and durable glass roofing tiles (Tesla Inc., 2018).

Solar Roof is also manufactured in-house in cooperation with Panasonic in the Gigafactory 2 in Buffalo, New York, where mainly photovoltaic cells, modules and solar panels are produced. It is possible to decide between four different patterns of the solar roof: textured, smooth, Tuscan and slate. Important to know is that solar panels were previously purchased on an as-needed basis from diverse suppliers but due to the cooperation with Panasonic these panels are now manufactured in-house as well.

Solar Roof works together with Tesla Powerwall 2 and consequently with Tesla also being able to provide the energy storage systems if requested. Moreover, Tesla developed internal software to reduce system design, installation timelines and costs.

The sales channel of solar and energy storage is very similar to these in the vehicle segment. Tesla sustains own stores in the U.S. by its' national sales organization but in the field of energy generation and storage also counts on network channel partners in the U.S. Outside of the U.S. these channels are currently used to sell Powerwall 2 systems. To also enhance its solar energy presence outside of the U.S., Tesla currently introduced pilot programs for the disposal of residential solar products in certain countries. Therefore Tesla does not only focus on the domestic market in the energy generation and storage segment but also strives to expand to other countries.

5.3.3 Acquisition of SolarCity

Tesla decided to acquire the energy generation company SolarCity, with the acquisition taking place on November 21, 2016 for the amount of $1,6 billion. SolarCity was administered by two of Musk's cousins and the company was considered one of the biggest or the biggest solar panel provider in the U.S. However, before the acquisition the company was in financial turbulences, leading Tesla to overtake high debt amounts of SolarCity during the acquisition which was followed by criticism about Musk and Tesla.

On the other side, the acquisition of SolarCity clearly implied which strategy Tesla is about to follow in the future: Further strengthen the status as a fully vertically integrated high-tech company with all the corresponding advantages of it, almost no matter at which costs.

5.4 Tesla – production

5.4.1 Car production

Manufacturing of vehicles and certain parts together with assembly operations is mostly conducted internally in the facilities in Fremont (California) in Gigafactory 1, Lathrop (California) and Tilburg (Netherlands).

Model S and Model X are mainly produced in the Tesla factory in Lathrop with manufacturing the lithium-ion battery packs, electric motors, gearboxes and several components there. Only a few major vehicle parts have to be purchased from external suppliers. This ensures also a high level of vertical integration in the manufacturing process of the Tesla Factory in Lathrop.

5.4.1.1 Gigafactory 1

Tesla's biggest project is the development of the world's biggest cell and battery manufacturing facility Gigafactory 1 in a desert close to Reno, Nevada. Tesla cooperates within the factory with several of its suppliers, such as Panasonic (long-term contract), which is assumed to ensure a smoother production of batteries in the future. The objective is to reduce the cost of lithium-ion battery packs by 30% (Morris, 2018).

Production in Gigafactory 1 comprises all energy storage products as well as the battery packs and the entire drive unit of Model 3.

According to Tesla's annual report the Gigafactory 1 is "designed to be the highest-volume and lowest-cost source of lithium-ion batteries in the world" (Tesla Inc., 2018, p. 9). The goal of Tesla is to fabricate 500,000 vehicles per year in this location aside of the production of energy storage products and to further expand the factory that the production will even exceed the 500,000 vehicles per year. Tesla wants to make use of economies of scale which will lead to a reduction of battery pack costs and to a higher competitive advantage. To reach this goal Tesla is currently spending a huge portion of its capital expenditures (CAPEX) on the expansion of the factory. The report also notes that additional cash and management resources are needed to follow the production plan of Model 3.

5.5 Summary – business model

After reviewing the business model, the first key driver of Tesla is the fully-electric car segment. It has high importance for Tesla to be vertically integrated in the EV market, meaning most parts of the manufacturing are conducted in its own factories. This ensures full control over its manufacturing process, quality standards and by cutting intermediates it can also generate a cost advantage compared to other car manufacturers that purchase most of their parts from external suppliers. Besides its car business the

company also provides solar energy generating, storing and selling channels with its Solar Roof and batteries for both commercial and private use. Tesla's goal is to combine all of its segments – EV cars charged by solar power provided by its Solar Roofs with energy either directly produced or stored by its own batteries – in order not to be just a company selling single articles but to create an entirely new living environment. The company wants to be present in the daily life of as many people and businesses as possible. Therefore also with its current and future car portfolio Tesla is trying to penetrate each single segment of the vehicle market, not only by offering diverse vehicles but equipping them with unique features in order to be superior to its competitors.

5.6 Analysis of the business model – will the business model survive?

Business models and companies can change quickly. Therefore it is important to evaluate if the business model of Tesla will survive in the future. The research paper "Business Model Warfare" by Langdon Morris is selected as a reference to assess these issues in case of Tesla. The paper work of Richard Foster & Sara Kaplan illustrates an increased mortality of companies that are inherent to adopt their business model to current circumstances. This is illustrated by the fact that the average life span of companies in the S&P 500 is steadily decreasing from more than 50 years to less than 25 years in 2001 and by saying that only one third of today's companies will survive as significant businesses for the next 25 years (Foster & Kaplan, 2001).

In order to justify a possible assumption of Tesla surviving in perpetuity and to assess a terminal value assumption of Tesla as reasonable, in the following, the business model warfare article will be practically applied on Tesla.

5.6.1 Main risks for the failure of the business model nowadays

The four main external criteria factors nowadays which represent the highest risk for the business model to fail and the highest impact to win the business model warfare are:

1. Accelerating change
2. Increasing competition
3. New technology
4. Increasing complexity

Additionally there are two internal criteria factors:

1. Innovation
2. Corporate decision making

As especially the external forces are almost impossible to influence but all criteria together, internal and external, incorporate the same importance as technology, market structure or competitive advantage. Consequently, the important question for the valuation of Tesla is "how the forces of change will affect a firm tomorrow and the day after" (Morris, 2013, p. 16) by not just looking at short term growth and profitability.

5.6.1.1 External criteria factors

As mentioned above external factors are almost impossible to influence but have to be answered with internal actions within the company. Therefore internal business model criteria are evaluated to assess how effectively Tesla is able to react on external factors.

- Accelerating change: According to the research paper the relevant question is: What is your strategy to deal with accelerating change?
- Vertically integrated company: Acquisition of SolarCity and mainly in-house production of vehicles → less flexibility to adopt to changes → betting on electric vehicles being the future of vehicles.
- Elon Musk: Personal strength of Musk to adapt fast to changes, invent new technologies, being a creative leader and not just following change but to be responsible for the change. This is also considered to be one of the reasons why he received a new contract with high enumerations in case of reaching specific goals.
- Increasing competition.

The competition in car market is steadily increasing, mainly caused by switches in the business model and the increased use of electric vehicles. Tesla will be able to withstand increasing competition if/due to:

- Due to diverse sources of revenues;
- If Tesla can stick to its production goals and announcements;
- Due to strong brand recognition;
- Due to future car introductions in diverse vehicle segments to increase market penetration.

On the other side Tesla will not be able to withstand increasing competition due to:

- Struggling production as a consequence of low experience in production process of mass market cars, can also lead to lose of positive brand recognition;
- High indebtedness and negative cash flows;
- New technology.

As the car market is currently in change, a lot of new technologies are introduced to the market. New technologies lead to accelerating change. Therefore these points are very similar.

Main aspects for Tesla are:

- Tesla considered one of the most innovative companies in the car segment: incorporation of latest technologies such as autonomous driving hardware with semi-autonomous software and change of setup of screens by Tesla to one single, big screen → followed by other companies from Chinese start-ups like BYD to established companies like BMW.
- CEO Musk high affinity to technologies proven by being in leading positions in other companies like SpaceX, Neuralink or Hyperloop.
- Increasing complexity.

The markets of operation of Tesla are expected to see high increases in complexity in the future due to changes of production processes and new technologies. Tesla will be able to withstand this due to:

- Vertically integration and cooperation: In-house development, production and experience throughout the entire value chain → high knowledge inflow and storage, also leads to improvements.

To sum it up, Tesla will likely be able to keep pace with new technologies and increasing complexity. A first threat might be accelerating change and the biggest external threat for Tesla being increasing competition, mainly due to current struggles in the production process which can also influence future manufacturing and the high amount of debt in combination with negative cash flows.

5.6.1.2 Internal criteria factors

Internal criteria are directly attributable to the performance of the company and consequently play a more important role in the evaluation of Tesla's business model competitiveness.

Innovation & corporate decision making

Innovation in general "refers to an attribute, a process and a result" (Morris, 2013, p. 17) with the result being "increased value in form of new or improved functionality, reduced cost, a price increase, price decrease, better margin for seller or some combination of these" (Morris, 2013, p. 17). Innovation therefore is highly related to and creates competitive advantages. Furthermore innovation does not necessarily involve new technology.

This also illustrates a study by Booz & Company which showed that the ten most innovative companies are not the companies with the highest R&D expenses (Veldhoen, 2013).

Table 10 illustrates possible innovation targets, the innovation strength of Tesla in these sectors (high, neutral, low) compared to competitors and lists innovations conducted in these sectors.

Table 10: Tesla business model analysis

Sector	+ Innovations / - Drawbacks	Innovation Strength
Business Structure	+ First vertically integrated car manufacturer → difficult to copy as linked to high expenditures (Fast Follower tactics difficult to apply) → But: Chinese vehicle start-ups adopting same business structure, even with own recycling of batteries (BYD) + Strong alliances - High amount of debt and negative cash flows	Medium
Administration	+ New level of automation in production process of Model 3 with less than 50 assembly steps per vehicle (70% less than conventional assembly lines)→ unreached by all other OEMs (AR 2017)	High
Organization	- Main facilities under construction - Low amount of production facilities → high risk if one facility malfunctions - High amount of working hours - Facility ineffectiveness and delayed improvement processes	Low
Customer Experience	+ Very strong brand recognition and charismatic CEO → high-tech vehicle company providing clean energy → no expenses for active advertisement	High
Customer Service	+ Own studios for sale and reparations → offer close customer relationship with fast, unfiltered feedback and established companies use channel of licensed shops owned by independent instances	High
Supply Chain	+ - significantly lower amount of suppliers, which can be both advantage and disadvantage	Medium
Product	+ Technology and user interface → EV with high-end technology and good look - Product availability and product offering	Medium
Corporate Decision Making	+ - Strong influence of CEO with strong influence on decision making	Medium

The article also mentions that nowadays the markets are changing too fast, and companies should not totally rely on R&D to gain a competitive advantage but rather maintain a strong relationship with customers. This is another additional positive feature of Tesla, maintaining a strong relationship to its customers and the customers show high loyalty.

In conclusion Tesla shows high innovation strength in terms of administration, customer experience and customer service, medium innovation strength in the sectors of business structure, product and corporate

decision making and reveals drastic weaknesses in terms of organization. Tesla's positive features significantly outweigh the negative ones in comparison to its competitors. Given the fact, hypothesis 2 that Tesla's business model is superior to those of its closest competitors, can be accepted.

The analysis is also used to derive competitive advantages of Tesla, which are listed in the chapter below.

5.7 Competitive advantages

Competitive advantages describe factors that prove Tesla superior to its competitors and by the company's ability to sustain or enhance these factors, the survival and success of the company can be assessed. In this thesis competitive advantages of Tesla are classified into two groups, depending on the strength of the competitive advantage (1. = very strong, 2. = strong).

1. First mover

With the release of the Model S in 2012 Tesla was considered to be the first car manufacturer that combines an engine powered by electricity in combination with design, interior and features of upper-class segment vehicles including entirely new features. Therefore Tesla gained a first mover advantage in this car segment, which is still sustained until 2018 as established companies like BMW or Volkswagen still struggle to smaller the gap to Tesla.

2. Strong brand recognition

As a consequence of being a first mover the company received high attention with positive feedbacks which was then the main driver for Tesla's very strong brand recognition. An evidence of this strong brand is the reservation amount of almost 500.000 vehicles for the Model 3 in the beginning of 2018 without the customers having reliable information regarding delivery date.

2. Vertically integrated

Another competitive advantage is the vertical integration of Tesla, especially compared to established companies like BMW, Volkswagen or GM. Whereas these companies receive their parts from a big bulk of suppliers, Tesla strives to manufacture almost the entire product in-house. This integration also includes its own sales channel, providing the company with immediate and unfiltered feedback, a deep customer orientation and possibly higher margins as intermediates are avoided. It also has the advantage of bundling knowledge and resources among the single segments which then can be applied anywhere within the company. For example Tesla is also using its know-how of energy management technologies and manufacturing processes for the vehicle powertrain systems and advances in battery architecture and power electronics of the vehicle segment are used in energy storage products.

By being vertically integrated and providing different products across the value chain, customers are able to combine these products. For example Solar Roof is able to work together with Powerwall 2, which can then recharge a Tesla vehicle. By combining these features of the vertical integration Tesla is able to provide its customers with an entirely new ecosystem, which is unreached by any other competitor. Additionally, due to the internal development of software, system design, installation timelines and costs were reduced.

One example of the vertical integration of Tesla is that Powerwall was recently introduced to Tesla's retail network. The company also started to install energy storage facilities in areas where currently no other source of energy for its cars can be found, for example in South Africa.

2. Superior technology and design compared to other electric vehicles

Tesla cars are considered to be the only electric vehicles combining an appealing exterior with high-technology and an electric engine in the car. Therefore if customers are looking for an electric vehicle which is combining these features, Tesla will be their first choice.

Furthermore a significant competitive advantage due to superior technology is that upgrades and enhancements of products are possible even after purchase. Whereas engines of established car manufacturers only provide the announced power, Tesla has the possibility to down- or upsize the battery capacity of its cars for a discount or surcharge by just performing real-time software updates. Due to these technological features Tesla is also considered to be the first car manufacturer with significant control over its vehicles even after selling them.

To sum it up, due to its strong competitive advantages and forward looking behavior, it is also possible to derive that Tesla's business model is superior to these of its closest competitors and therefore hypothesis 2 can be accepted.

5.8 Subsidies

Table 11 illustrates government subsidies granted during 2016, which is also the reason why the table is just used as a reference to illustrate the focus different countries put on the development of electric vehicles as the amount of incentives changed in many countries over the past years.

Table 11: Electric vehicle subsidies by countries

Country	At Purchase (€)	Annual (€)	City or State (€)	Total (€)	Total subsidies in EV price (%)
South Korea	13.488	-	6.400	19.888	30%
Denmark	19.466	-	-	19.466	49%
Norway	14.113	1.794	-	15.907	45%
China	$2.362-$7.877	-	-	14.469	23%
U.S.	6.989	-	2.330	9.319	18%
France	6.300	-	-	6.300	18%
Netherlands	3.380	2.808	-	6.188	17%
U.K.	5.298	210	-	5.508	15%
Japan	4.396	-	-	4.396	10%
Germany	4.000	360	-	4.360	13%
Sweden	4.156	-	-	4.156	12%

China has one of the highest reward programs for the purchase of electric vehicles. Additionally, certain cities offer diverse rewards as well, for example electric cars are exempt from registration fees which are due for cars with an internal combustion engine (ICE). In 2018 China announced several changes in its subsidy program. Battery electric vehicle subsidies range from $2.362 to $7.877 depending on the vehicle range and plug-in hybrid subsidies are $3.467. China decreased the subsidies for low range battery electric vehicles (BEV) strongly while slightly increasing them for BEV with a range more than 300 km. The subsidies of plug-in hybrid electric vehicles (PHEVs) were slightly cut by 8%, nevertheless the Chinese government is still trying to support the development of PHEVs. The amount that can be claimed as governmental subsidies is a combination of the factors of EV range, energy density of the battery pack and the electric consumption per 100km with technical requirements further increasing in 2018 pushing the car makers to further improvements in battery energy density and vehicle energy efficiency. Further countries that are diminishing subsidies are Denmark, France, Portugal, and Norway.

German incentive mechanisms include motor vehicle tax exemption, low purchase tax, dedicated parking and others. The United States also offer tax credits for the purchase of electric cars, free parking, free registration and more. However, compared to China, these incentives seem smaller, which can be also seen as a reason for the strong development of the Chinese EV-market.

The current trend in the subsidies of single countries is to further lower them and abolish them in most countries within a few years. Furthermore the tax credit in the U.S. is only valid for the first 200.000 vehicles sold, which is expected to be exceeded by Tesla within the upcoming six months.

To sum it up, subsidies currently display a strong incentive to consider the purchase of an EV, however, according to recent events and own assumptions these subsidies are expected to further diminish and not play a role in the decision making of future customers anymore.

6 Car market – an outlook

Future revenues form the basis the DCF valuation of Tesla. A first appropriate benchmark to evaluate future revenue growth rates of Tesla is to look into historical and expected growth rates within the market to evaluate how the company is performing against the market and derive future trends. As Tesla is retrieving main parts of its revenues from the disposal of cars, the car market is considered being Tesla's main field of operations. Therefore a strong spotlight in this thesis is put onto the historical and future development of the car and especially EV market. Firstly the current situation and expected disruptions are described, which is followed by an analysis of the overall vehicle market, world passenger car market and an more detailed analysis of the world EV market. Firstly, the analysis will be conducted related to countries, which will be followed by switching to OEMs to draw conclusions about Tesla's closest competitors and future competition within the car market.

6.1 Current market and disruptions

The car market is in a cycle of transition. Three disruptive trends in the car market can be identified that will cause big chances in the future:

1. **Electric vehicles**
2. **Autonomous driving**
3. **Car sharing**

These disruptive changes in the car market will shift the entire set up of the market from a hardware-driven, manufacturing market to the direction of the software market, also with consequences for future margins and risks, including Tesla. To receive a precise picture of Tesla's future growth, Tesla's position within these segments has to be evaluated.

6.1.1 Car sharing

Car Sharing is just in the beginning, with many years of development to come. Furthermore possible revenue sources for car manufacturers out of this field are considered to be low in comparison with other developments in the market. Consequently, car sharing will just have a very limited impact on the success of Tesla.

Nevertheless Tesla plans to introduce its own car sharing platform, called Tesla Network, within the next years, similar to other car manufacturers, to stay competitive also in this field. Hence it is assumed that Tesla will have a similar position as its competitors in this sector but it will not have a significant impact on the business model, revenues or profitability in the future.

6.1.2 Autonomous driving

On the other side, autonomous driving will disrupt the entire vehicle and transportation industry. On the last stage of autonomous driving, no driver will be needed anymore to direct the vehicle. However, this stage is still unreached. Currently almost all OEMs include self-driving features into their cars.

The current hardware for enhanced autopilot of Tesla, which is included in each car manufactured since October 2016, includes following main features:

- Eight cameras with a 360-degree range of vision;
- Each camera can see up to 250 meters;
- 12 ultrasonic sensors , important for recognition of hard and soft objects;
- On the highway the autopilot can control the speed according to the cars around;
- If the hands of the driver are too long away from the steering wheel, the car will make the driver pull over → protection as the autopilot is not fully autonomous yet;
- If destination is reached the car can identify open parking spots and control either parallel or perpendicular parking.

In addition a good indicator for the current development of autonomous driving among companies is the number of permissions for autonomous vehicles in California. The companies holding the first five places as of March 2018, including the amount of permitted autonomous vehicles, are listed below:

1. General Motors: 110
2. Apple: 45
3. Tesla: 39
4. Uber: 29
5. Waymo: 24

With Tesla being ranked in the top three among permissions for autonomous vehicles in California, it is considered that Tesla is highly competitive in this market and will keep pace with developments in the future. Furthermore, autonomous driving is considered to have a significant impact on the company's business model in the future. By already providing each car with the hardware for autonomous driving and adding these software features as soon as it is developed enough, the company is also partially seen as a software company. Additionally, this part of the business model is also where the CEO, Elon Musk, can extensively bring in his enormous expertise and previous experience as before Tesla, Musk co-founded Zip2, a web software company, which was then followed by founding X.com which became PayPal after being acquired by eBay in 2002.

6.2 Car market sales – by Geography

Nevertheless the main part of Tesla's business model is the disposal of electric vehicles. To analyze future growth of Tesla in this field it is necessary to analyze the growth in the market. The best indicator to measure growth in the car market is to analyze sales data. Firstly, this will be done by looking at geographic differences and growth figures to obtain an impression of the current situation on the car market, especially which countries are main sales drivers, which then serves as the fundament for future assumptions. Data were retrieved from the official OICA database. The analysis of the current market also enables to check forecasts for consistency and to adjust them in case of inconsistency with current developments. For the analysis a top-down approach is applied, starting with the entire vehicle market, followed by the passenger car market and the EV market, which is split into battery electric vehicle market (Tesla's market of operation) and plug-in hybrid market.

6.2.1 Passenger car market

Firstly the passenger car market is analyzed which is the fundament for the electric vehicle market in which Tesla directly operates. Additionally sales data of the passenger car market are compared to these of the EV market to draw conclusions about current and future size development of the EV market. Data are retrieved from the official OICA Database.

Table 12: Passenger car market sales analysis by country or region

Regions / Countries	2015	2016	2017	CAGR ('12 – '17)
All Countries	**66.327.133**	**69.506.882**	**70.849.466**	**3,06%**
%-yoy-growth	0,95%	4,79%	1,93%	
Asia / Oceani / Mid East	**36.109.867**	**39.488.189**	**40.747.025**	**6,18%**
%-yoy-growth	3,66%	9,36%	3,19%	
%-margin of total sales	54,44%	56,81%	57,51%	
China	**21.210.339**	**24.376.902**	**24.961.948**	**10,01%**
%-yoy-growth	7,62%	14,93%	2,40%	
%-margin of total sales	31,98%	35,07%	35,23%	
India	**2.772.270**	**2.966.637**	**3.227.701**	**3,02%**
%-yoy-growth	7,84%	7,01%	8,80%	
%-margin of total sales	4,18%	4,27%	4,56%	
Japan	**4.215.889**	**4.146.459**	**4.391.100**	**-0,81%**
%-yoy-growth	-10,29%	-1,65%	5,90%	
%-margin of total sales	6,36%	5,97%	6,20%	
Europe	**16.410.563**	**17.291.819**	**17.937.345**	**2,07%**
%-yoy-growth	1,59%	5,37%	3,73%	
%-margin of total sales	24,74%	24,88%	25,32%	
France	**1.917.226**	**2.015.177**	**2.109.890**	**2,13%**
%-yoy-growth	6,76%	5,11%	4,70%	
%-margin of total sales	2,89%	2,90%	2,98%	
Germany	**3.206.042**	**3.351.607**	**3.442.100**	**2,23%**
%-yoy-growth	5,57%	4,54%	2,70%	
%-margin of total sales	4,83%	4,82%	4,86%	
U.S.	**7.516.826**	**6.872.729**	**6.096.111**	**-3,39%**
%-yoy-growth	-2,24%	-8,57%	-11,30%	
%-margin of total sales	11,33%	9,89%	8,60%	
Africa	**1.142.250**	**979.014**	**862.907**	**-5,65%**
%-yoy-growth	-8,35%	-14,29%	-11,86%	
%-margin of total sales	1,72%	1,41%	1,22%	

After analyzing world passenger car market sales, following conclusions can be made.

- Passenger car market sales stable positive growth rates → world car market considered to be relatively stable and robust.
- Asia / Oceania / Middle East accounts for more than 50% of total car sales with higher growth rate than overall market → most important market and gain of further share in the market.
- China biggest single market with 35% of total annual car sales per year → but: latest growth rate was strongly decreasing → decreased expectations for future growth rates in the market → but due to size still considered by far most important single market for car manufacturers.
- India: Small market compared to population but latest growth rates very strong → growing importance in the future.
- Europe: Stable growth rates and therefore stable market, with Germany being the biggest single market in Europe with growth slightly higher than in the total car market during the last year, high growth rates especially in France during the last years.
- U.S. high amount of total sales but fast diminishing → only in 2017 a sales decrease of more than 11% → from 2015 to 2017 annual car sales decreased by almost 1.5 million units → loses its significance in the overall market.
- Africa: Small and decreasing market, only slightly more than 1% of total sales → insignificant market.

6.2.2 Electric vehicle market

The market segment in which Tesla directly operates, due to a pure electric product portfolio, is the EV market. Total unit sales figures for the overall EV market were obtained from ev-volumes.com which is considered to be a highly reliable source for information regarding the EV market. The following analysis of the separate pure electric vehicle market and plug-in hybrid electric vehicle market were conducted based on data retrieved from Bloomberg Intelligence. Data from both sources do not correspond entirely, leaving a small deviation in the amount of cars sold per year. However, this deviation is considered very low as conclusions are not affected by these.

6.2.2.1 Total battery electric & plug-in hybrid electric vehicle market

Table 13 illustrates the development of sales in the electric vehicle market with yoy-growth rates, %-margin of total EV sales and a %-margin of EV sales in the region or country in comparison to passenger car sales in the same region or country for the same year, for its most important regions and countries. Data were retrieved from ev-volumes.com.

Table 13: Total battery and plug-in hybrid electric vehicle market sales analysis by country

Regions / Countries	2015	2016	2017	CAGR ('14 – '17)
Total	**539.000**	**773.600**	**1.223.600**	**57,13%**
%-yoy-growth	70,89%	43,53%	58,17%	
%-margin of pas. Car sales	0,81%	1,11%	1,73%	
China	**191.000**	**351.000**	**606.000**	**118,62%**
%-yoy-growth	229,31%	83,77%	72,65%	
%-margin of total EV sales	35,44%	45,37%	49,53%	
%-margin of pas. Car sales	0,90%	1,44%	2,43%	
Europe	**193.000**	**222.000**	**308.000**	**46,98%**
%-yoy-growth	98,97%	15,03%	38,74%	
%-margin of total EV sales	35,81%	28,70%	25,17%	
%-margin of pas. Car sales	1,18%	1,28%	1,72%	
U.S.	**115.000**	**157.000**	**200.000**	**18,56%**
%-yoy-growth	-4,17%	36,52%	27,39%	
%-margin of total EV sales	21,34%	20,29%	16,35%	
%-margin of pas. Car sales	1,53%	2,28%	3,28%	
Japan	**25.000**	**22.000**	**56.000**	**20,51%**
%-yoy-growth	-21,88%	-12,00%	154,55%	
%-margin of total EV sales	4,64%	2,84%	4,58%	
%-margin of pas. Car sales	0,59%	0,53%	1,28%	
Other	**15.000**	**23.000**	**55.000**	**82,83%**
%-yoy-growth	66,67%	53,33%	139,13%	
%-margin of total EV sales	2,78%	2,97%	4,49%	
%-margin of pas. Car sales	0,09%	0,14%	0,31%	

6.2.2.2 Battery electric vehicle market

The electric vehicle market can further be split into the battery electric vehicle market, meaning the motor being batteries and the plug-in hybrid electric vehicle market, which adds plug-in features to standard engines. As Bloomberg Intelligence provides more detailed information regarding the subgroups of the EV market, the top-down approach is further applied by analyzing the battery electric vehicle market, in which explicitly Tesla operates. The analysis also comprises figures or ratios that allow putting these two subgroups into relation and compare them to each other and as well as to the overall electric vehicle market. Included are %-yoy-growth rates of both markets and its countries, %-margins of sales in relation to BEV sales and %-margins of sales in relation to total EV sales. To get an impression of the average growth rate compounded. CAGRs for each region for the years 2014 – 2017 were added. The results are presented in table 14.

Table 14: Battery electric vehicle market sales analysis by country

Regions / Countries	2015	2016	2017	CAGR ('14 – '17)
Total BEV	**236.014**	**413.630**	**700.192**	**67,9%**
%-yoy-growth	59,5%	75,3%	69,3%	
%-margin of total EV sales	53,1%	59,5%	64,3%	
China	**56.961**	**203.552**	**422.405**	**214,3%**
%-yoy-growth	318,5%	257,4%	107,5%	
%-margin of total BEV sales	24,1%	49,2%	60,3%	
%-margin of total EV sales	48,8%	71,4%	79,2%	
U.S.	**72.165**	**85.299**	**103.807**	**19,5%**
%-yoy-growth	18,7%	18,2%	21,7%	
%-margin of total BEV sales	30,6%	20,6%	14,8%	
%-margin of total EV sales	62,8%	54,0%	53,5%	
Norway	**26.379**	**24.414**	**32.794**	**23,9%**
%-yoy-growth	52,9%	-7,4%	34,3%	
%-margin of total BEV sales	11,2%	5,9%	4,7%	
%-margin of total EV sales	77,0%	54,1%	53,7%	
France	**20.393**	**26.556**	**30.028**	**39,0%**
%-yoy-growth	82,6%	30,2%	13,1%	
%-margin of total BEV sales	8,6%	6,4%	4,3%	
%-margin of total EV sales	78,8%	79,5%	74,2%	
Germany	**12.312**	**11.450**	**21.382**	**39,2%**
%-yoy-growth	55,2%	-7,0%	86,7%	
%-margin of total BEV sales	5,2%	2,8%	3,1%	
%-margin of total EV sales	55,1%	45,0%	42,7%	
Japan	**10.777**	**15.203**	**17.441**	**2,4%**
%-yoy-growth	-33,6%	41,1%	14,7%	
%-margin of total BEV sales	4,6%	3,7%	2,5%	
%-margin of total EV sales	46,5%	73,9%	35,7%	
U.K.	**9.853**	**10.674**	**14.828**	**36,5%**
%-yoy-growth	68,9%	8,3%	38,9%	
%-margin of total BEV sales	4,2%	2,6%	2,1%	
%-margin of total EV sales	35,4%	27,3%	30,6%	

Below the single measures and its implications used are described to evaluate and analyze the EV market:

- %-yoy growth rate: Positive growth rate implies market is growing, negative rate implies a shrinking market, if yoy-growth higher compared to rate in the total EV market than margin increases, implying higher share in the total EV market sales
- %-margin of total BEV sales: calculates the ratio of the single country's sales to the overall sales in the BEV market. If the single market is growing stronger as the overall market, margin will increase, implying bigger sales market.
- %-margin of total EV sales: puts the sales in the BEV market into relation to sales in the entire EV market of the country or region, allows conclusions about competitiveness of the BEV market compared to the PHEV, as a growing market implies more sales in the BEV in relation to PHEV sales.
- %-margin of passenger car sales: mainly allows conclusions about growth path of EV in the total and single markets and with which velocity

6.2.2.3 Conclusions

After analyzing the EV and BEV market, following conclusions can be made.

Total EV market:

- Strongly growing market with high yoy-growth rates as well as a very high CAGR of 57,13% from ’14-’17.
- In 2017 breached barrier of one million sales per year for the first time.
- Sales margin compared to passenger car sales steadily growing each year implying that share of electric vehicles in the car market is steadily increasing.
- However: With less than 2% of sales in 2017 the EV market is still a very small market.

Total BEV market:

- The market in which Tesla directly operates gains higher sales shares of the total EV market year by year with 64.3% of total electric sales being battery vehicles due to higher growth rates of battery vehicle sales compared to hybrid sales → worldwide growing higher relevance and demand for battery electric vehicles than for plug-in hybrid vehicles → it is expected that at some point the BEV will completely overtake PHEV market sales.
- In general high growth rates throughout last three years with almost always above 60% increase of sales per year.

China

- Highest amount of actual sales in the EV market and the BEV and despite its bigger size still almost constantly highest yoy growth rates and CAGRs in both markets → market with by far highest relevance for EV sales and especially BEV sales → gains market shares from all other countries → main growth driver of the BEV and total EV market.
- Share of battery vehicle sales is constantly growing, implying focus on this solution rather than on plug in vehicles → in 2017 almost 80 % of all electric vehicle sales were battery electric vehicles compared to 2015 were this sales rate was even below 50% → high importance especially for Tesla as it focuses entirely on BEVs with more than 60% of all BEV sales generated in China in 2017.

U.S.

- EV high growth rates and constantly gaining market share from total car sales, but lower growth rates than the total EV market → loses market shares to other countries and regions.
- Battery electric vehicle sales are also growing annually with almost 20% per year, but also slower than the total BEV market → also loses market shares and importance to other countries → BEV sales

portion of total EV sales is constantly declining → less importance and demand for pure electric vehicles and higher importance of the PHEV market → U.S. is Tesla's biggest market → risk for Tesla in the future and company needs to expand to countries where BEV growth and share in the total EV market is growing with also high total amount of sales → China very high importance for Tesla.

Europe

- Second most important EV market with second highest sales units per year and yoy-growth rates.
- Norway: Biggest single BEV market in Europe mainly due to high subsidies → but: expected to change as demand limits due to relatively small population and BEV loses slightly market share to PHEVs → will receive lower relevance in the future with switch to other European countries.
- France: Decreasing growth in the BEV the last years compared to stronger growth in the PHEV market but still second biggest market in Europe.
- Germany: High growth in 2017 but PHEV market also stronger in Germany with regards to total sales and growth rates.
- Summary: Europe focuses currently more on PHEV even though growth rates of BEV are also high.

To sum it up China puts high hopes and spotlights on the battery electric vehicle market. With substantial investment dollar, government subsidies, and an environmentally aware consumer base, China is the next primary market for electric car manufacturers (Chierotti, 2017). Most of the other countries around the world also report strong growth rates in the EV and BEV market but with stronger focus on the PHEVs.

6.2.3 Future actions in the car market – by geography

Future incentives as well as target EV sales ratios of governments are of high importance for the assessment of the future development of the EV market and are therefore of high importance for future sales estimations of Tesla. Therefore the most important aspects are illustrated, including several forecast figures of UBS and Morgan Stanley research papers which are used as a benchmark for the future estimation of EV sales units. The table with current and future actions, main sales drivers, expected growth rates and comparison to own predictions can be found in the appendix under table 1.

An interpretation of the estimated numbers will be conducted later in the article as at this point of time further information are needed to draw correct conclusions. The purpose of this illustration is to summarize the actions and goals single countries and regions undertake and present the influence of these incentives on the future EV market ad its size. This table is also used to put ratios and growth rates estimations in the future EV market, which are estimated later on in this work, into an appropriate framework of the analysis conducted by different investment banks to benchmark own results and ensure

reasonability of own forecasts. The direct comparison of countries' targets on the forecasted growth rates and sales figures illustrates and ensures reasonability of these forecasts and makes it easy for the reader to follow the logic strain and arguments of the estimations.

6.3 EV market sales – by original equipment manufacturers (OEMs)

The latest interruptions in the car market also caused new competitors, often subsidized by their governments, to enter the market. Start-up companies, mainly from China such as BYD and BAIDU, are already highly successful in their home markets and are now competing with companies like Tesla, Volkswagen or BMW for shares in the world EV market.

For the analysis of Tesla's closest competitors a top-down approach was applied. Starting point is the total electric vehicle market, sorting companies by total sales in 2017 starting from the companies computing the highest annual sales units and going downwards from there. Afterwards focus will be put onto the battery electric vehicle market as these companies are considered to be Tesla's closest competitors.

Similar measures with similar implications as in the country analysis are used:

- %-yoy growth rates: Positive growth rate implies EV sales of the company are growing, if yoy-growth of the OEM higher compared to sales rate growth in the total EV market than EV sales margin and therefore market share of the OEM increases, the growth rate can also be put in comparison to Tesla's growth rate.
- %-margin of total EV sales: calculates the ratio of company's EV sales to the overall sales in the EV market → growing margin implies increase in market share & allows conclusions about company's EV presence and closeness of competition to Tesla.
- %-margin of total BEV sales: calculates the ratio of company's BEV sales to the overall sales in the BEV market → growing margin implies increase in market share & allows conclusions about company's BEV presence and closeness of competition to Tesla.
- %-margin of vehicle sales of OEM: puts the EV sales in relation to the overall vehicle sales of the car manufacturers → mainly allows conclusions about growth path of EV in the sales share of car producers and gives impressions on total size of competitor.

Data for total EV sales by OEMs of 2016 & 2017 were retrieved from ev-volumes.com to ensure consistency with sale volumes of the EV market by geography. Data of total OEM vehicle sales were retrieved from Bloomberg Intelligence. As the EV market is relatively young and strongly growing, reliance only on historical growth rates to derive at future growth is not very appropriate, as these figures will significantly change over time. Consequently, only sales figures of the last two years were chosen to give a most recent impression of the latest changes and developments in sales volumes in combination

with ’15 – ’17 CAGRs. The analysis of past sales units, growth rates and margins in the total electric vehicle market can be found under table 2 in the appendix.

After retrieving and analyzing the sales volumes of single car manufacturers, the table provides a first insight into possible competitors of Tesla in the EV market. To ensure reasonability of the choice of competitors also Tesla’s direct market of operations, the pure battery electric vehicle market, is analyzed in the next chapter.

6.3.1 Battery electric vehicle market

Sales volumes of OEMs in the battery electric vehicle market were retrieved from Bloomberg Intelligence. In order to receive the total EV sales margin Bloomberg Intelligence total sales data for the BEV market for the single car manufacturers were divided by Bloomberg Intelligence total sales data of the single car manufacturers for the BEV plus PHEV market to ensure internal consistency with the ratios. The results of the analysis of the battery electric vehicle market are under table 3 in the appendix.

After analyzing sales numbers of both markets, the total EV market and the battery EV market, the closest competitors of Tesla can be identified related to the companies being the closest to Tesla’s sales numbers in the EV and battery EV market.

Companies that are the closest to Tesla regarding sales volume are: BAIC, Nissan-Renault, BYD, Geely, General Motors (GM), BMW, Volkswagen (VW), Hyundai – Kai, SAIC and Daimler.

Additional car manufacturers were chosen according to their announced strong focus on EV production programs in the future. These companies are: Volvo, Audi and Toyota.

Besides these companies, especially China produces a high amount of start-up companies in the EV segment, mainly due to the high amount of government subsidies. After extensive research, the following start-up companies are considered to be possible competitors of Tesla in the future: Byton and NIO.

Moreover it is to mention that all Chinese car manufacturers (BYD, BAIC, SAIC, Geely, Byton, NIO), considered being direct competitors of Tesla, are highly government subsidized and account for most of the sales in China, currently their main market of operation. However, as these companies are growing with extremely high growth rates, it is assumed that they strive to expand to other markets in the future. Moreover Tesla is already operating and selling cars in the Chinese market, turning these companies into direct competitors of Tesla.

6.4 Competitor analysis

The selection of closest competitors is also based on the business model of the companies, their presence in the same markets and their sales volumes in these markets. Nevertheless, it is not possible to exclude that companies, which are currently not considered as important players in the EV market, might compete with Tesla in the future. Especially in China, where the Chinese government issued 15 production permits to companies until June 2017 with twelve permissions to companies "relatively new to the auto industry" (Morgan Stanley Research Center, 2017 (II), p. 32). Another reason for growing competition is shrinking entry barriers into the market mainly due to higher outsourcing possibilities in the production process.

However, to deeper understand future sales and market share developments, a closer look at the identified closest competitors and their future strategy will be conducted. The goal is to determine how Tesla is able to overcome the challenges of high competition in the current and future market and if the company is able to sustain or enhance its market share and with regards to competition ensures a going concern in the future.

After identifying Tesla's closest competitors, their current EV models are briefly described to set a framework for the current competition of Tesla. This is followed by putting a stronger spotlight on future strategies of these companies. This will be combined with a chronicle listing of future car introductions and their main features to assess if Tesla can gain an advantage over its competitors in the future or not. Based on these decisions future market shares of Tesla will be predicted and be benchmarked against the analysis and predictions of the EV market previously conducted.

Note: Established car manufacturers like Volkswagen, BMW or General Motors already have their assembly lines and entire supply chain in place and are highly experienced and skilled in the production process, which will be considered a huge competitive advantage compared to Tesla which will not be additionally described for each company separately but included into the final prediction of Tesla's future revenues.

The main illustration of the closest competitors of Tesla, their current and future programs and targets related to the EV market and a comparison to Tesla can be found in table 4 of the appendix.

After summarizing and illustrating these main programs and EV targets of Tesla's closest competitors and comparing these companies and their features to Tesla the following conclusions can be made:

1. Established car manufacturers like VW and Audi, BMW or Daimler put high focus on future EV introductions and can be considered a future competition driver in the industry. Most of these companies announced ambitious sales target within the next decade which is backed by high amount of investments. Currently, Tesla is assumed to have strong competitive advantages over these companies, mainly due to brand recognition, first mover advantage and technology. However, it is assumed that especially the first mover advantage and technology shrink over time. Tesla, which is currently in a leading position in EV as well as in autonomous driving is expected to feel increased competition from these companies in the future with direct impact on sales numbers and margins.
2. Chinese companies are expected to further grow with high growth rates, especially in their home market China, as this market is assumed to grow heavily within the next years. After a few years of growth in the market, it is assumed that these companies also strive to expand worldwide, with the consequence of further increasing the competition in the market for Tesla. It is assumed that especially the two start-up companies, Byton and NIO, can turn into significant threats for Tesla if the companies will be able to take the hurdle into breaking into the market with stable sales numbers as both manufacturers offer cars in the same upper-class segment with similar or even better features for lower prices, which will be further described during the direct comparison of future models.
3. It is estimated that established car manufacturers also keep up with Tesla by providing a charger network, now starting in Europe. Backed by high amounts of cash reserves this companies will be able to further decrease the distance to Tesla.
4. Tesla is assumed to keep its competitive advantages, mainly in the areas of technology and brand recognition, but with significant decrease in impact on sales numbers.

The column current comparison to Tesla provides a detailed comparison of each manufacturer or company to Tesla, which gives a precise overview of the current and future expected situation in the market. This analysis is also used for sales unit estimations in the later part of this work.

6.5 Future car introductions

Table 15 illustrates all concrete future car model introductions within the next years that can be considered a threat for Tesla. Furthermore it also includes an assessment of the advantages and disadvantages compared to its closest competitors of the Tesla product portfolio and a conclusion about future loss or gain as a consequence out of this evaluation. The list therefore provides a benchmark for future growth of Tesla. Items which are mostly compared are the main sales drivers of EV in the car market according to the UBS research paper. This comprises purchase price, range, access to charging stations and performance.

A general advantage of Tesla cars is the good access to charging stations, which however is assumed to decrease over time. Nevertheless, Tesla drivers can either use own Tesla charging spots or access public charging stations by using special adapters. Therefore this is a big advantage which is not mentioned for each model comparison but it always considered in the evaluation process.

Table 15: Future car introductions and comparison to Tesla

OEM	Year	Model Launches	Range Price Features	Competitive Model / Advantage (+) Disadvantage (-) compared to Tesla	Gain (+) / Loss (-) for Tesla compared to competitor (Assumption)
Audi	Late 2018	e-tron Quattro (Crossover)	311 miles, Fast charging, Max. 496 hp, 0-60 miles in 4,6 sec. $80.000-$100.000	Model S = Similar features	=
GM	2018	Chevrolet Bolt	238 miles $37.500 Heated steering wheel	Model 3 -features -brand recognition	+
Nissan	2018	Leaf	107 miles $29.990 Enhanced autopilot	Model 3 -range -power +cheaper	+
Nissan	2018	Micra EV	-	Model 3 -branding -range	+
Jaguar	July 2018	i-Pace (Crossover)	More than 200 miles 400 HP, 0-60 mph in 4 seconds $87.000	Model X/Model S = similar features	=/+
BMW	Oct. 2018	BMW i3	More than 200 miles	Model 3/Model S	+
2019					
Audi	June 2019	e-tron Sportback (Crossover)	More than 200 miles	Model S/Model X = strong branding = similar features	=/-
Mercedes	June 2019	ELC (SUV)	More than 200 miles	Model X	=
Volvo	2019	Electric XC40 SUV	More than 200 miles $35.000 - $40.000	Model 3 -features	+
Mercedes	Oct. 2019	C-Class	More than 200 miles	Model S	=
Mini	Oct. 2019	Unnamed (maybe Countryman)	More than 200 miles	Model 3 - features	+
Porsche	Oct. 2019	Mission E	More than 200 miles, 582 HP Fast charging 15 minutes	Model S	=
2020					
BMW	2020	X3	More than 200 miles	Model X = range	=

OEM	Year	Model Launches	Range Price Features	Competitive Model / Advantage (+) Disadvantage (-) compared to Tesla	Gain (+) / Loss (-) for Tesla compared to competitor (Assumption)
Ford	2020	Model E (Crossover)	More than 200 miles	Model S / Model X	+
Smart	2020	Unnamed	More than 200 miles	Model 3	+
Volkswagen	2020	I.D.	Release in European and U.S. market $30.000	Model 3	= / -
Volkswagen	2020	I.D. Crozz (Crossover)	250 miles 80% battery charge in 30 minutes	Model S = range + fast charging	=
Audi	2020	Unnamed (Compact model)	More than 200 miles	Model S / Model 3	=
NIO	2020	EP9	265 miles, top speed 194 mph $68.000 0-124 mph in 7,1 seconds Interchangeable battery system with a one Megawatt battery, equivalent to 1342 BHP → chargeable in 45 minutes	Tesla Roadster and all upper-class EV cars	- (In case all features and price like announced)
NIO	2020	Launch of all vehicles in the U.S.	Including NOMI, a voice activated artificial intelligence digital companion	Strong competition to all Tesla models	-
Mercedes	By 2020	9 more EQ BEVs		Strong competition to all Tesla Models	=
Volkswagen	2020	I.D. Compact	250 miles	Model 3	= / -
Byton	2020		International delivers of all models	Strong competition to all Tesla Models	=
2021 and later					
Tesla	2021	Model Y (Crossover)	No side mirrors, hardware for autonomous driving integrated and similar features as Model S and X	-	-
BMW	2021	Unnamed	Four-door sedan	Model S	=
BMW	2021	BMW i4	More than 500km, format of 3-series	Model S	-
All Brands	2022	-	101 new EVS hit the market by 2022	All Models	= / -
Tesla	2022	Semi-Truck	See description in business model	-	-
Volkswagen	2022	I.D. Buzz (Microbus)	First in U.S. market	-	-
Volkswagen	Later than 2022	I.D. Vizzion	413 miles, 302 HP, no steering wheel Fully autonomous car, communication via speech and gestures	Model S / Model X + range +features	-
Tesla	2024	Roadster (sports car)	620 miles, 200 kWh $200.000-$250.000 0 to 60 mph in less than two seconds(WR), all-wheel drive	-	-

Note: Prices are all listed prices, which are starting prices with serial equipment.

A comparison of single models, with roll-outs being more than two to four years in the future, is providing very limited predictability as the development cycle of a new model averages around two to four years. Therefore, after 2020, sales forecasts and market share developments of Tesla will be compared to the overall strategies of its competitors to arrive at reasonable growth rates for Tesla.

The table confirms the assumptions made in the previous part of the thesis. The competition is significantly growing in the EV market with high investments and new introductions from both established car manufacturers and start-up companies, mainly from China. Especially the introductions of the established German premium brands is assumed to be a significant threat as these cars provide similar or even superior features as well as strong brand recognition and a wide customer base. Therefore table 19 provides an important framework and benchmark for Tesla's future sales unit development and ensures reasonability of forecasts.

6.6 Tesla in the Future

After analyzing future actions and incentives of Tesla's closest competitors it is also important to look at targets Tesla set for its own future development and success. The following sequence lists Tesla's most important actions and goals for the future:

- Tesla plans to increase the production of cars to 1 million vehicles by 2020.
- Tesla signed a preliminary agreement with officials of Shanghai to build facilities in the Lingang development zone which is considered to be another Gigafactory in Shanghai.
- The highest importance for the future of Tesla has the improvement of the production process of its mass market car, the Model 3 in order to turn profitable in the future.
- Tesla announced plans to build three additional Gigafactories within the next five years.
- Roll-out of autonomous driving pilot by 2020.

With an increase to one million vehicles by 2020, Tesla would be able to generate a market share in the total EV market of almost 25% and a market share of more than 35% in the BEV market according to own forecasts of the EV and BEV market. Knowing the current production problems of Tesla and a sales volume of only 100.000 vehicles in 2017 this assumption does not seem reasonable. However, investments into new production sites and further goals to intensify production ramp-up of Model 3 are considered positive for the future of Tesla. Therefore this information is also included into sales estimations of Tesla vehicles in the future.

After the analysis of single EV markets, the Chinese market is considered to be the most important market for future EV sales. Therefore a more detailed look will be taken on Tesla's latest and planned actions in the market to assess Tesla's future success in China.

Present situation:

- Three largest Superchargers are located in China, one in Shanghai and two in Beijing.
- Currently Tesla has 1.000 Supercharger and 2.000 Destination chargers across the country.
- The company expanded retail and service presence to over 35 locations in 2017. The next phase in China will be to establish local production in order to avoid import duties – especially with the imminent launch of the Model 3 in the country (Lambert, 2018 (I)). The company is working with the government of Shanghai to build a manufacturing facility but actual production is still a few years away.
- Revenues in China grow steadily:

2014: $477 million → 2015: $318 million → 2016: $1 billion (11.000 EV sold) → 2017: $2 billion (20.000 EV sold)

Tesla announced three primary goals in China:

- Expansion of share in the world's largest EV market
- Keeping independency by avoiding regulations to enter into a Joint Venture
- Protection of intellectual property built into the EV cars

China is assumed to be a very important market for Tesla in the future, which is also illustrated on the heavily increasing annual revenues generated in this market. However, future success of Tesla depends on several factors such as government barriers such as important tariffs and the inner-market competition intensity with Chinese car manufacturers and especially German premium brands, which are already well-placed on the Chinese market due to their past sales volumes and investments.

6.7 Competition analysis

This chapter provides an additional estimation of the competition in the market with special relations to the single models of Tesla and therefore more into details which is summarized in table 20. Until 2017 the Model S and Model X both are considered to have competitive advantages over their competitors, mainly due to look, interior, features and branding. This is also displayed in the latest sales figures of 2017 with the Model S being the most sold EV in the U.S. and Europe with a total sales volume of 53.978 vehicles and the Model X being the most sold electric SUV worldwide and the fourth most sold BEV with 44.966 units.

The basis assumption how to start the analysis of competition is that both vehicles, as well as the Model 3 in the mass market, hold significant advantages over their competitors. On the other side, especially the Model S does not show almost any sales growth since 2015 (2015: 50.368, 2016: 50.751, 2017: 59.978).

This implies that as soon as some serious competition appears the Model S could fear to lose some amount of its market share.

Based on the analysis above following conclusions about the future market share development of Tesla can be made which will serve as the fundament for future revenue growth. However, a deeper analysis will follow when sales units of single EV models are estimated as well as for the estimation of future revenue growth in the energy generation and storage sector.

Table 16: Future competition analysis

Year	Impact on market share of Tesla
2018	New introductions especially competing with Model X and Model S and partially with Model 3. Tesla's models considered superior to most models, only threats, especially for Model X and partially for Model S are the Audi e-tron and especially the Jaguar i-Pace → keep competitive advantage on the same level, Tesla announced expectations for sales of all three Models which will be applied for 2018.
2019	Stronger competition especially by German premium brands → Tesla considered equal to these brands and gain of small market share over remaining brands, mainly due to competitive advantage of Model 3, for Model S and X it is possible that they partially lose their standalone basis in the EV market.
2020	Further growing competition by German premium brands BWM, Mercedes and VW (with Audi) and also Chinese start-ups (Geely, NIO, BAIC, BYD) entering the world market with premium cars and relatively cheap prices → strong competition for Tesla's Model S and Model X → assumption that market share growth only possible through growth of Model 3 sales with growing competition from Chinese manufacturers.
2021 and later	Growing competition on high level like 2020 mainly due to further product enhancements of German brands and Chinese start-ups that strive to export their vehicles → from 2020 on strong competition in market and these years are decisive for future of Tesla → assumption: Model S and X considered comparable to competitive models, but losing their stand-alone basis to equivalent product introductions of the German car manufacturers and Chinese start-ups can advantage due to low prices → main growth possible through Model 3 Introduction of Model Y: possible to gain advantage in the compact SUV class and gain market shares from German competitors → however: no significant advantage over these competitors → Model Y is expected to grow sales strongly, however: will not strongly outperform entire market as competition too strong from 2020 on.

The analysis of the competition in the current and future market, the detection and analysis of Tesla's closest competitors in conjunction with the analysis of Tesla's most important markets of operation serve as the fundament and framework for applying a DCF valuation on Tesla.

7 Valuation model

For the purpose of valuation of Tesla several fundamental assumptions are made:

- The valuation is conducted in nominal terms.
- The forecast period was set to ten years, as the company is considered to be in a high growth phase throughout the next five years and afterwards growth rates are assumed to converge to the growth rate of the economy.
- Date of valuation is the 31st of December 2017.

7.1 Future car & EV market

As a reference for own sales predictions in the EV market, diverse researches of Investment banks such as UBS, Morgan Stanley, Blackrock and McKinsey were analyzed in order to be in line with common sense in the market. The own forecast will then be used as a benchmark for Tesla's future growth in the EV market to ensure reasonable assumptions. This forecast is also put into relation to the expected total passenger car market growth to ensure reasonable estimations. The entire forecast, which comprises total EV market sales and BEV market sales, is presented below. The first illustration shows estimations for the entire EV market, which is followed by a forecast of BEV sales. In both cases, the forecasted period amounts to ten years until the year 2027, as after this period Tesla's business and growth figures are expected to be in steady state. Table 17 provides an overview of sales unit estimations in single countries in regions for the period of the next ten years.

Table 17: Forecast total electric vehicle market sales by country

EV market (in thousands)	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	CAGR
Total	**1.790**	**2.654**	**4.048**	**5.556**	**7.512**	**10.087**	**13.281**	**17.461**	**21.970**	**26.442**	**36,0%**
%-yoy-growth	46,3%	48,3%	52,5%	37,3%	35,2%	34,3%	31,7%	31,5%	25,8%	20,4%	
%-m. pas. Car sales	2,5%	3,7%	5,5%	7,5%	10,0%	13,3%	17,3%	22,5%	28,1%	33,4%	
China	**1.000**	**1.600**	**2.560**	**3.392**	**4.324**	**5.405**	**6.487**	**7.784**	**9.185**	**10.746**	**33,3%**
%-yoy-growth	65,0%	60,0%	60,0%	32,5%	27,5%	25,0%	20,0%	20,0%	18,0%	17,0%	
%-m. total EV sales	55,9%	60,3%	63,2%	61,0%	57,6%	53,6%	48,8%	44,6%	41,8%	40,6%	
%-m. pas. Car sales	3,9%	6,2%	9,6%	12,5%	15,6%	19,2%	22,5%	26,5%	30,6%	35,1%	
Europe	**400**	**581**	**900**	**1.395**	**2.162**	**3.297**	**4.863**	**6.930**	**9.009**	**10.811**	**42,7%**
%-yoy-growth	30,0%	45,0%	55,0%	55,0%	55,0%	52,5%	47,5%	42,5%	30,0%	20,0%	
%-m. total EV sales	22,4%	21,9%	22,2%	25,1%	28,8%	32,7%	36,6%	39,7%	41,0%	40,9%	
%-m. pas. Car sales	2,2%	3,1%	4,7%	7,2%	10,9%	16,3%	23,5%	32,8%	41,8%	49,1%	
Other	**77**	**108**	**151**	**226**	**340**	**509**	**764**	**1.146**	**1.662**	**2.326**	**45,4%**
%-yoy-growth	40,0%	40,0%	40,0%	50,0%	50,0%	50,0%	50,0%	50,0%	45,0%	40,0%	
%-m. total EV sales	4,3%	4,1%	3,7%	4,1%	4,5%	5,0%	5,8%	6,6%	7,6%	8,8%	
%-m. pas. Car sales	0,4%	0,6%	0,9%	1,3%	1,9%	2,9%	4,4%	6,6%	9,6%	13,5%	
Japan	**78**	**94**	**122**	**171**	**240**	**336**	**503**	**755**	**1.057**	**1.321**	**37,2%**
%-yoy-growth	40,0%	20,0%	30,0%	40,0%	40,0%	40,0%	50,0%	50,0%	40,0%	25,0%	
%-m. total EV sales	4,4%	3,5%	3,0%	3,1%	3,2%	3,3%	3,8%	4,3%	4,8%	5,0%	
%-m. pas. Car sales	1,8%	2,2%	2,8%	4,0%	5,7%	8,0%	12,1%	18,2%	25,7%	32,3%	
U.S.	**234**	**271**	**315**	**372**	**446**	**539**	**664**	**846**	**1.058**	**1.237**	**20,0%**
%-yoy-growth	17,0%	16,0%	16,0%	18,0%	20,0%	21,0%	23,0%	27,5%	25,0%	17,0%	
%-m. total EV sales	13,1%	10,2%	7,8%	6,7%	5,9%	5,3%	5,0%	4,8%	4,8%	4,7%	
%-m. pas. Car sales	3,9%	4,6%	5,4%	6,5%	7,9%	9,7%	12,1%	15,7%	19,9%	23,6%	

The BEV sales development is especially essential for the decision of how the sales amount of BEV develops in comparison to PHEV sales over time. This in turn allows conclusions about the market size of the BEV market, in which Tesla explicitly operates – the pure electric vehicle market. It also serves as a benchmark for the estimations of Tesla's vehicle sales in the future as ratios of Tesla's future market share can be derived out of these calculations. The table below shows total sales figures of the BEV market in conjunction with some of its most important single markets. The ratios calculated provide a deep inside into the future development of the market and ensure reasonability of the estimations.

Table 18: Forecast battery electric vehicle market sales by country

BEV Market (in thousands)	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	CAGR
Total	**1.144**	**1.767**	**2.788**	**3.846**	**5.228**	**7.098**	**9.472**	**13.063**	**16.971**	**21.203**	**40,6%**
%-yoy-growth	63,4%	54,5%	57,8%	38,0%	35,9%	35,8%	33,4%	37,9%	29,9%	24,9%	
%-m. total EV sales	63,9%	66,6%	68,9%	69,2%	69,6%	70,4%	71,3%	74,8%	77,2%	80,2%	
China	**739**	**1.257**	**2.099**	**2.865**	**3.767**	**4.822**	**5.882**	**7.147**	**8.469**	**9.918**	**37,1%**
%-yoy-growth	75,0%	70,0%	67,0%	36,5%	31,5%	28,0%	22,0%	21,5%	18,5%	17,1%	
%-m. ttl. BEV sales	64,6%	71,1%	75,3%	74,5%	72,1%	67,9%	62,1%	54,7%	49,9%	46,8%	
%-m. EV sales	73,9%	78,5%	82,0%	84,5%	87,1%	89,2%	90,7%	91,8%	92,2%	92,3%	
Germany	**28**	**42**	**68**	**111**	**183**	**305**	**509**	**827**	**1.207**	**1.496**	**52,9%**
%-yoy-growth	33,0%	49,0%	61,0%	63,0%	65,0%	66,5%	66,5%	62,5%	46,0%	24,0%	
%-m. ttl. BEV sales	2,5%	2,4%	2,4%	2,9%	3,5%	4,3%	5,4%	6,3%	7,1%	7,1%	
%-m. pas. Car sales	0,8%	1,2%	1,9%	3,0%	4,8%	7,8%	12,7%	20,1%	28,7%	34,9%	
France	**36**	**50**	**76**	**117**	**184**	**288**	**439**	**657**	**900**	**1.107**	**43,4%**
%-yoy-growth	20,0%	40,0%	50,0%	55,0%	57,0%	56,5%	52,5%	49,5%	37,0%	23,0%	
%-m. ttl. BEV sales	3,2%	2,9%	2,7%	3,0%	3,5%	4,1%	4,6%	5,0%	5,3%	5,2%	
%-m. pas. Car sales	1,7%	2,3%	3,4%	5,1%	7,9%	12,0%	18,0%	26,3%	35,3%	42,5%	
U.S.	**173**	**184**	**208**	**241**	**291**	**364**	**466**	**618**	**797**	**956**	**24,9%**
%-yoy-growth	67,0%	6,0%	13,0%	16,0%	21,0%	25,0%	28,0%	32,5%	29,0%	20,0%	
%-m. ttl. BEV sales	15,2%	10,4%	7,4%	6,3%	5,6%	5,1%	4,9%	4,7%	4,7%	4,5%	
%-m. EV sales	74,1%	67,7%	65,9%	64,8%	65,4%	67,5%	70,3%	73,0%	75,4%	77,3%	
U.K.	**19**	**29**	**46**	**75**	**121**	**193**	**299**	**451**	**631**	**782**	**48,7%**
%-yoy-growth	31,0%	48,0%	60,0%	62,0%	62,0%	59,5%	55,5%	50,5%	40,0%	24,0%	
%-m. ttl. BEV sales	1,7%	1,6%	1,6%	1,9%	2,3%	2,7%	3,2%	3,4%	3,7%	3,7%	
%-m. pas. Car sales	0,7%	1,0%	1,6%	2,5%	3,8%	5,8%	8,7%	12,5%	16,8%	20,0%	
Japan	**23**	**27**	**34**	**49**	**71**	**105**	**168**	**277**	**429**	**579**	**41,9%**
%-yoy-growth	30,0%	17,0%	27,0%	45,0%	45,0%	48,0%	60,0%	65,0%	55,0%	35,0%	
%-m. ttl. BEV sales	2,0%	1,5%	1,2%	1,3%	1,4%	1,5%	1,8%	2,1%	2,5%	2,7%	
%-m. EV sales	28,9%	28,2%	27,5%	28,5%	29,5%	31,2%	33,3%	36,7%	40,6%	43,8%	
Norway	**44**	**62**	**85**	**112**	**140**	**175**	**186**	**194**	**198**	**202**	**19,9%**
%-yoy-growth	35,0%	40,0%	37,5%	31,5%	25,0%	25,0%	6,0%	8,0%	2,1%	2,1%	
%-m. ttl. BEV sales	3,9%	3,5%	3,1%	2,9%	2,7%	2,5%	2,0%	1,5%	1,2%	1,0%	
%-m. pas. Car sales	27,1%	37,0%	49,4%	63,2%	76,8%	94,1%	97,7%	100,0%	100,0%	100,0%	
Others	**81**	**117**	**173**	**276**	**470**	**846**	**1.523**	**2.893**	**4.253**	**5.996**	**59,2%**
%-yoy-growth	40,0%	45,0%	48,0%	60,0%	70,0%	80,0%	80,0%	90,0%	47,0%	41,0%	
%-m. ttl. BEV sales	7%	7%	6%	7%	9%	12%	16%	22%	25%	29%	

The estimations of future EV sales units are reflections of the analysis conducted before related to countries' future strategies and incentives in combination with its sales volume development throughout the past year. Therefore these numbers align to the statements made before and ensure reasonability of own estimations. For regions and countries "Other" and Japan the forecast of UBS was applied as currently no further information are available for these markets. The forecasts are mainly used to calculate Tesla's sales margins and compare them to competitors' margins to ensure plausibility of estimations.

7.2 Risks

Tesla is facing several risk factors that are threatening the going concern assumption of the business and have to be incorporated into the valuation of the company. A going concern assumption and its assessment is highly important for the valuation process as it determines forecast period, terminal year assumptions and possible liquidation probabilities. The following three chapters show the issues which are considered to be the biggest going concern risks of Tesla in the present and future.

7.2.1 Production ramp-up risk

Tesla as a start-up company has no previous experience in its field of operation. This is currently visible in the production delay of Model 3. It is possible that these problems can also be faced during the introduction of consecutive models, leading into lower margins due to adjustments in the production process and a decrease in cash flows. As a consequence, Tesla might not be able to service its interest payments on its debt.

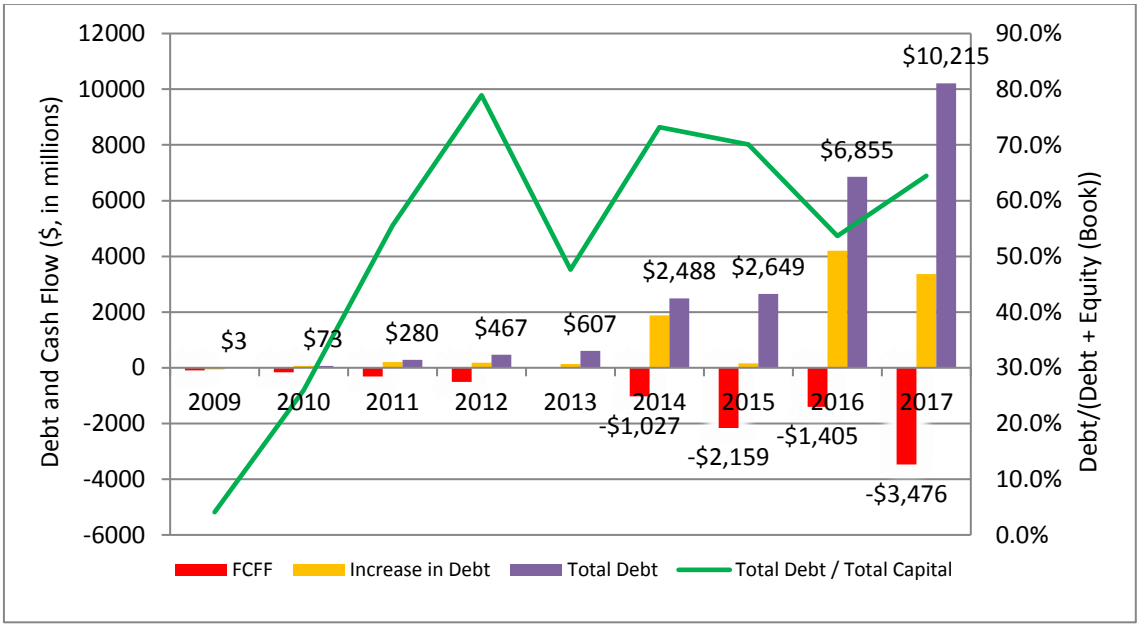
7.2.2 Regulation risk

The EV market is still in its beginning with little or no regulations in most areas. Also the market of autonomous driving, which is also an important field for Tesla, only has relatively minor regulations. It is expected that with further growth of these markets also the regulations will increase. In both segments future regulations can put Tesla at additional risk, depending on the strength of these regulations. Even though it is not possible to predict the future development and actions in these fields, this additional risk has to be beard in mind.

7.2.3 Financial risk

The current and future financial risk of Tesla is considered to be one of the most significant risks for the survival and therefore going concern assumption of Tesla. The graph below illustrates the past and current debt load of Tesla.

Figure 1: Financial risk of Tesla



The graph shows negative operating cash flows for almost each year, which implies that the company is theoretically not able to meet its obligations to all stakeholders. However, negative cash flows for a growth company like Tesla are per se not bad, as the company heavily invests in growth. But an aspect that is worrying is the fact that at the same time the total debt of Tesla is steadily increasing implying further interest burdens for the company as the company is financing big parts of its growth with debt. This is shown by a total-debt-to-total-capital ratio of 64,5% which strongly increased from 53,7% in 2016. This way of financing in combination with negative cash flows increases the financial risk of the company, especially if the company is not able to become profitable soon. Tesla's current choice of financing especially becomes a big problem if the access to the capital market becomes more difficult for Tesla. That is the reason why growth companies like Tesla usually finance their growth by issuing additional shares instead of taking on interest-bearing debt.

In the future financial risk will strongly depend on how the company decides to finance itself and how fast the company is able to turn profitable in order to serve their financial obligations. For this purpose it is assumed that Tesla will preferably issue equity instead of debt for the purpose of financing, especially after a downgrading in the credit rating of Tesla is expected, making additional debt even more expensive for Tesla. It is expected that Tesla will need additional capital in the future, as the automotive business is

relatively capital intense, making it necessary to keep or even increase its capital expenditures, for example for additional production plants.

The company currently also accounts for a negative return on invested capital (ROIC) of -7,3% after adjustments, which is significantly below the WACC of 7,54%, implying additional risk for Tesla as the company generates lower returns in comparison to its costs.

One more indicator of financial well-being is the interest coverage ratio. It calculates by how many times the company is able to cover the interest expense through its operating income.

$$\text{Interest coverage ratio} = \frac{\text{Operating income}}{\text{Interest expense}}$$

In case of Tesla, this ratio is even negative as the company shows a negative operating income in 2017. It implies that the company is not able to finance and cover its interest expense with its operations.

7.2.4 Growing competition risk

The illustrations in chapter 4 depict that starting from year 2020, the competition in the EV market will sharply increase. Established car manufacturers are using their big cash reserves to invest heavily into new EV introductions and start-ups, especially from China, urge into the world EV market, supported by Government incentives and strong domestic sales. This is considered to be a strong threat for Tesla, as Tesla relies on its strong growth within the next years, to play out its economies of scale in its factories to increase profit margins and turn profitable. If the company fails to withstand this threat, especially in combination with its high debt burden and interest payments and an eventual delay of future EV introductions, the going-concern assumption of Tesla is under threat.

7.2.5 Probability of failure

The possible risks of Tesla, which might have a strong impact on the going concern assumption of the company, are translated into a probability of failure rate. This rate is assessed to be approximately 20%, implying that with a probability of 20% the company will not be able to keep up the going concern assumption in perpetuity. This is mainly attributable to the difficult financial situation and the growing competition in the market.

A probability of failure is included into the valuation as the expected cash flows of Tesla do not incorporate any likelihood of failure and the cost of capital does not incorporate any market risk associated with probability of failure. Consequently a probability of failure rate is estimated to adjust the operating asset value for this probability (Damodaran, 2012).

The probability rate of failure will be considered in the valuation by assessing that in case of non-survival of Tesla, the company will be able to generate a distressed sale value from its assets.

7.3 Tesla – a story stock

Defining the story of Tesla is an important and vital step in the valuation of the company as all numbers and assumptions should be attached to a part of the company's story or the overall story of the firm.

Tesla in general is seen as a story stock, meaning its main value is retrieved from future growth, the firm's growth assets, and not by its assets-in-place. Tesla's main business operation is the disposal of battery electric vehicles but the company is not only seen as a car manufacturer. In fact, the company is rather seen as a fully vertically integrated company which combines features of a car manufacturer with features of an energy generation and storage company and features of a software company. Tesla's activities in the car segment are obvious through the disposal and leasing of mostly new but also partially used cars. The energy generation segment is assumed to be rather an add-on to the purchase of its own cars to be able to combine Tesla features and charging abilities under one roof. This segment is currently changing as the company rather strives for margin improvements than gathering market share, which also supports the story described above. The energy storage business was already highly successful throughout the last years and is expected to contribute high revenue growth rates in the near future, as Tesla's technologies in this field are highly competitive and the market growth related to capacity demand is expected to grow with triple digits year over year. Therefore it is assumed that this part of Tesla's business model will become even more important in the future implying that the margin of total revenues of this business will grow over time. Moreover Tesla is also evaluated as a high-tech company, as both, the car segment and the energy segment, are including more and more high-tech into their products. This incorporation of high-tech into its products is assumed to be even stronger compared to its competitors, making it possible for Tesla to operate with higher total margins compared to its competitors as high-tech companies are usually able to generate higher margins.

Through Tesla's competitive advantages described in the sections above, it is assumed that Tesla will be able to converge to the margins of the upper 80% - to 90% - quantile of its competitors in both the automotive as well as in the energy segment which are assumed to be sustained as a consequence of sustaining competitive advantages.

Tesla is operating in a segment of the car market which is in high growth and which is also assumed to be in high growth almost over the entire next decade. This will lead to different consequences for Tesla. On the one side the competition will grow significantly within the next years until 2025, making it difficult for Tesla to retain its market share. On the other side as the market is rapidly growing, even partially

losing market shares could still imply Tesla to be able to grow with two double-digit numbers in sales volumes and revenues. Therefore the story of growth for Tesla in the car segment will be that due to intensified competition the company will slowly lose market share as Tesla's cars will be exposed to growing competition, which will shrink their related competitive advantages, but as Tesla is operating in a very fast growing market and as main competitive advantages such as strong brand value and vertically integration will be sustained, the company will still be able to sustain growth rates of around 20% – 25% per year throughout almost the entire upcoming decade in both sales units and revenue growth.

Another part of the story related to future costs of production is the assumption that due to its vertical integration and steadily reaching economies of scale, production costs will significantly shrink in the future, having positive impact on operating margins. The Gigafactory in Nevada, currently the biggest production plant for lithium-ion batteries worldwide, is expected to play an important role in that game. As battery costs currently account for a large portion of overall EV production costs, the economies of scale and cost advantages which are expected to be reached by Gigafactory, as soon as the production of Model 3 works smoothly and the expansion of the factory further progresses, will put Tesla into even stronger competitive advantages resulting in even higher margins in the future.

Additionally, operating margins and discount rates will also incorporate features of the different segments attached to Tesla, with Tesla's current margins and discount rate converging to the target margins, derived from the weights of the sectors of operation, over time.

Further aspects of the story and assumptions are described more into details during the valuation process to link the calculated numbers to the story and assumptions.

7.4 Adjustments of financial statements

The theory of adjusting financial statements to properly reflect the company's performance, which was described in the theoretical part of this work, is now applied on the example of Tesla.

7.4.1 Normalization of financial statements

The annual report 2017 of Tesla was examined to search for so called non-recurring items. For this purpose the financial statements were viewed to search for positions, especially in the income statement and cash flow statement that demarcate one-time charges. In addition, a word search for words such as "extraordinary", "non-recurring", one-time" or "unusual" was applied in order to allocate paragraphs in the annual report that contain non-recurring items. Nevertheless, the annual report did not show any items, which might be reasonable due to the fact that Tesla is still in the cycle of growth and therefore non-recurring items are difficult to locate.

7.4.2 Calculation of fully diluted shares outstanding

In order to correctly calculate the value per share for Tesla, the overall amount of fully diluted shares outstanding has to be calculated. In case of options and warrants the treasury stock method (TSM) is applied and in case of convertibles and equity-linked securities the if-converted method is used to calculate the total amount of fully diluted shares outstanding.

7.4.2.1 Treasury Stock Method TSM

The basic amount of shares outstanding for Tesla is 165.758.000. The amount of 10.881.025 in-the-money call options of Tesla with a weighted average strike price of $105,56 which is below the share price of Tesla as of 31st of December 2017 of $311,64, resulting in net new shares from options of 7.195.359 and in fully diluted shares outstanding of 172.953.359 as it is shown in table 19.

Table 19: Calculation of fully diluted shares outstanding for options

Assumptions	**$ or units**
Share Price (as of 31.12.2017)	$311,64
Basic Shares Outstanding	165.758.000
In-the-money Options	10.881.025
Weighted Average Exercise Price	$105,56

Calculation of Fully Diluted Shares Outstanding Using the TSM	
Option Proceeds	1.148.600.999
/ Current Share Price	$311,64
Shares Repurchased from Option Proceeds	3.685.666
Shares from in-the-money Options	10.881.025
Less: Shares Repurchased from Option Proceeds	3.685.666
Net New Shares from Options	**7.195.359**
Plus: Basic Shares Outstanding	165.758.000
Fully Diluted Shares Outstanding	**172.953.359**

Tesla also issued warrants which have to be included in the calculation of fully diluted shares outstanding. 579.137 in-the-money warrants (weighted average exercise price: $105,56) result in net new shares from warrants of 382.969 which will be added to the previously calculated fully diluted shares outstanding to arrive at a total amount of 173.336.328 shares.

Table 20: Calculation of fully diluted shares outstanding for warrants

Assumptions	$ or units
Share Price (as of 31.12.2017)	$311,64
New Basic Shares Outstanding	172.953.359
In-the-money Options	579.137
Weighted Average Exercise Price	$105,56

Calculation of Fully Diluted Shares Outstanding Using the TSM	
Option Proceeds	61.133.702
/ Current Share Price	$311,64
Shares Repurchased from Option Proceeds	196.168
Shares from in-the-money Options	579.137
- Shares Repurchased from Option Proceeds	196.168
Net New Shares from Options	**382.969**
+ Basic Shares Outstanding	172.953.359
Fully Diluted Shares Outstanding	**173.336.328**

7.4.2.2 If-converted method

For GAAP reporting purposes once converted, the convertible bonds have to be treated as equity and "included in the calculation of the company's fully diluted shares outstanding and equity value" (Rosenbaum & Pearl, 2013, p. 33).

These options also have to be in-the-money, meaning the conversion price has to be under the current share price. All information were sourced and collected from Tesla's latest annual report. There are two convertible bonds, which are in-the-money with a conversion price of $124,52 and $300,00 respectively. The conversion of these bonds will lead into incremental shares of 5.677.020 which will increase the fully diluted shares outstanding to 179.013.348,2 shares.

As other conversion prices are above the share price of $311,64 and therefore out-of-the-money, these convertibles are not considered for dilution. The calculations are provided in table 21.

Table 21: Calculation of fully diluted shares outstanding for convertible bonds

If – Converted Method Convertible Bond 1	$ or units
Amount Outstanding	660.000.000
/ Conversion Price	$124,52
Incremental Shares	**5.300.353,4**
+ Fully Diluted Shares Outstanding TSM	173.336.328
Fully Diluted Shares Outstanding	**178.636.681,5**

If – Converted Method Convertible Bond 2	$ or units
Amount Outstanding	113.000.000
/ Conversion Price	$300,00
Incremental Shares	**376.666,7**
+ Fully Diluted Shares Outstanding TSM	178.636.682
Fully Diluted Shares Outstanding	**179.013.348,2**

Consequently, the total amount of fully diluted shares outstanding for Tesla is 179.013.348,2 shares.

7.4.3 Treatment of operating leases

As it was described in the theoretical part, operating leases are converted into capital leases to show the actual financial situation of the company, by adding the present value of operating leases to the book value of debt and by adding the imputed interest expense to the operating income before tax, as operating lease expenses are treated as financing expenses. The adjustments of the book value of capital and operating income are illustrated below. All information regarding the operating lease expenses can be retrieved from Tesla's annual report.

Table 22: Operating lease adjustment – PV of operating lease expense

Year	Operating Lease Expense (in tsd.)	Discount rate of unsecured debt	Present Value at 7,40% pre-tax cost of debt (in tsd.)
1	$224.630	7,4%	$209.143
2	$204.335	7,4%	$177.131
3	$175.612	7,4%	$141.736
4	$156.552	7,4%	$117.642
5	$130.802	7,4%	$91.515
Year 6 – 8 (annuity)	$141.765	7,4%	$258.379
PV of Operating Lease Expense			**$995.545**

1. Capital adjustment: Discounting of future lease commitments back to the present by the pre-tax cost of debt being the firm's cost of unsecured debt.

Table 23: Operating lease adjustment – capital adjustment

Capital Adjustment	$, in thousands
Book Value of Debt	10.314.868
+ PV of operating leases	995.545
= Adjusted Book Value of Debt	**11.310.413**
+ Book Value of Equity	4.237.242
Adjusted Book Value of Capital	**15.547.655**

The adjusted book value of debt is $11.310,4 million and the adjusted book value of capital is $15.547,7 million.

After the capital adjustment is conducted the operating income is adjusted for operating lease expenses

2. Income adjustment: Operating leases are treated as fixed commitments for the future including interest payments added back to operating income before tax.

Table 24: Operating lease adjustment – income adjustment

Income Adjustment	$, in thousands
PV of Operating Lease Expense	995.545
* Interest rate	7,4%
Imputed interest expense	**73.720**
Operating Income before Tax	(1.632.086)
+ Imputed Interest Expense	73.720
Adjusted Operating Income b. Tax	**(1.558.366)**

Consequently, the adding back of the imputed interest expense increased the pre-tax operating income. After dealing with these adjustments, forecasts estimated.

7.4.4 Treatment of R&D expenses

As stated in the theoretical part, R&D expenses are creating benefits over multiple periods which therefore have to be capitalized with the steps of reclassification being applied. R&D expenses of Tesla for its latest year were retrieved from its annual reports from 2014 – 2017.

Firstly, an assumption was made about how long on average it takes for R&D to be converted into commercial products in the car market and how long it might take for Tesla. After extensive research this period was set to three years which is in line with common market consensus. This period is described as the amortizable life of the research asset. As the period was set for three years, one-third of the R&D expenses of the underlying years are amortized each year to be fully amortized after three years to show a research asset of $2.173,6 million according to calculations in table 25.

Table 25: Research and development adjustment – amortization

Year	R&D Expense $, in thousands		Unamortized Portion $, in thousands	Amortization this year $, in thousands
Current Year	1.378.073	1,00	1.378.073	
-1	834.408	0,67	556.272	278.136
-2	717.900	0,33	239.300	239.300
-3	464.700	0,00	0,00	154.900
Unamortized Value			**2.173.645**	
Amortization this year				**672.336**

After amortizing one-third of the past three years R&D expenses, the total amortization for this year equals $672.336,00 (in thousands) and a total unamortized value of $2.173.645,00 (in thousands).

The adjustments of pre-tax operating income and equity are presented in table 26 and table 27.

Table 26: Research and development adjustment – income adjustment

Pre-tax Operating Income Adjustment	$, in thousands
Adjusted Pre-Tax Operating Income from Op. Lease(2017)	**(1.558.366)**
+ R&D expense 2017	1.378.073
- Amortization this year	672.336
= +/- Total adjustment to Pre-Tax Operating Income	**705.737**
Fully Adjusted Pre-Tax Operating Income (2017)	**(852.629)**

Table 27: Research and development adjustment – capital adjustment

Equity and Capital Adjustments	$, in thousands
Book Value of Equity (2017)	4.237.242
+ Value of Research Asset	2.173.645
Adjusted Book Value of Equity (2017)	**6.410.887**
Market Value of Equity (2017)	55.787.720
+ Value of Research Asset	2.173.645
Adjusted Market Value of Equity (2017)	**57.961.365**
Adjusted Book Value of Capital after Operating Lease Adjustment (2017)	15.547.655
+ Value of Research Asset	2.173.645
Fully Adjusted Book Value of Capital	**17.721.300**

Pre-tax operating income is adjusted by adding back R&D expenses of the current year and subtracting the amortized amount of the current year.

Equity and Capital adjustments are done by adding the so called value of the research asset, which equals the total unamortized portion, to the book/market value of equity respectively capital. The market value of equity is retrieved by multiplying the amount of fully diluted shares by the share price as of the 31st of

December 2017. Fully diluted shares are used as they also incorporate warrants and stock options outstanding which have to be included in the calculation of the market value of equity.

These pre-adjustments are necessary to correctly illustrate the current profitability and capital situation of Tesla. Moreover, these numbers serve as the starting point of convergence to the target profitability and capital ratio measures over time.

7.5 Revenue recognition

Revenues of Tesla are, according to its business model, based on two segments: The automotive segment with sales and leasing and the energy generation and storage system and a third sector can be identified with additional service revenues, mainly from reparation, maintenance and disposal of used cars.

For the purpose of revenue prediction it is important to understand what kind of revenues Tesla is generating and when they will be recognized. The following chapter describes these issues.

Revenues are recognized according to Tesla's Annual Report, when:

i) A persuasive evidence of an arrangement exists;
ii) Delivery has occurred and there are no uncertainties regarding customer acceptance;
iii) Pricing or fees are fixed or determinable;
iv) Collection is reasonably assured.

7.5.1 Automotive revenues

7.5.1.1 Automotive sales

Automotive sales revenues include:

- Deliveries of new vehicles;
- Sales of regulatory credits to other automotive manufacturers (ZEV or zero-emission vehicles credit) → Zero-emission vehicles manufacturer earns regulatory credits and may sell excess credit to other manufacturers as these companies also need to comply to regulatory requirements.
  2017: $360,3 million – 2016: $302,3 million – 2015: $168,7 million.

7.5.1.2 Automotive leasing

Automotive Leasing Revenues (to customers & leasing partners) include:

- Direct leasing programs and programs with resale value guarantees;
- Customer: Option of customer to sell back to Tesla during guarantee period for determined resale value (currently end of the term of the applicable loan or financing program);

- Leasing Partner: At the end of lease term either repurchase of vehicle from leasing partner for resale value guaranteed or payment of a shortfall to the guarantee amount the leasing partner may realize on the sale of the vehicle.

7.5.2 Energy generation and storage

- Recognition in case of energy generation product when solar energy system installed and passed inspection;
- Recognition in case of energy storage product when product is delivered, installed and accepted by the customer.

7.5.3 Service and other

- Repair and maintenance services, service plans, merchandise, sales of used Tesla vehicles, sales of electric vehicle powertrain components and systems to other manufacturers and sales of non-Tesla vehicle trade-ins.

7.6 Revenue forecast

The revenue forecast is considered to be the most challenging part of the valuation, especially in the case of growth companies like Tesla.

One way of dealing with revenue forecasts is to look at past growth as an indicator of future growth. The growth development of revenues in the single sectors is illustrated below.

Table 28: Past total revenue analysis

$, in thousands	2015	2016	2017	CAGR ('15 – '17)
Total Revenues	**4.046.025**	**7.000.132**	**11.758.751**	**70,5%**
%-yoy-growth	26,5%	73,0%	68,0%	
Automotive sales	**3.431.587**	**5.589.007**	**8.534.752**	**57,7%**
%-yoy-growth	19,4%	62,9%	52,7%	
%-margin of total sales	84,8%	79,8%	72,6%	
Automotive leasing	**309.386**	**761.759**	**1.106.548**	**89,1%**
%-yoy-growth	133,4%	146,2%	45,3%	
%-margin of total sales	7,6%	10,9%	9,4%	
Energy generation & storage	**14.477**	**181.394**	**1.116.266**	**778,1%**
%-yoy-growth	244,0%	1153,0%	515,4%	
%-margin of total sales	0,4%	2,6%	9,5%	
Services & other	**290.575**	**467.972**	**1.001.185**	**85,6%**
%-yoy-growth	55,3%	61,1%	113,9%	
%-margin of total sales	7,2%	6,7%	8,5%	

However, in the case of young growth companies and especially Tesla with its latest production problems and expected heavy changes in production volume in the future, reliance on past growth performances are

linked to high probabilities of biases in the forecast. The only benchmark what will be used in the future, as it is also related to the business model of Tesla, is the revenue margins of the single sectors and the convergence to what is assumed the target margins and business model in steady state of these current margins.

The revenue forecast approach that will be applied for Tesla is to actually read through the company's strategy and targets, its revenue growth potential by analyzing Tesla's main revenue drivers and draw own reasonable assumptions also incorporating growth in the market, competition, competitive advantage and further factors that were described and analyzed in the first part of this work.

7.6.1 Main factors of future revenue growth

For the revenue forecast, it is important to correctly analyze the main revenue growth drivers of the company, which are listed below.

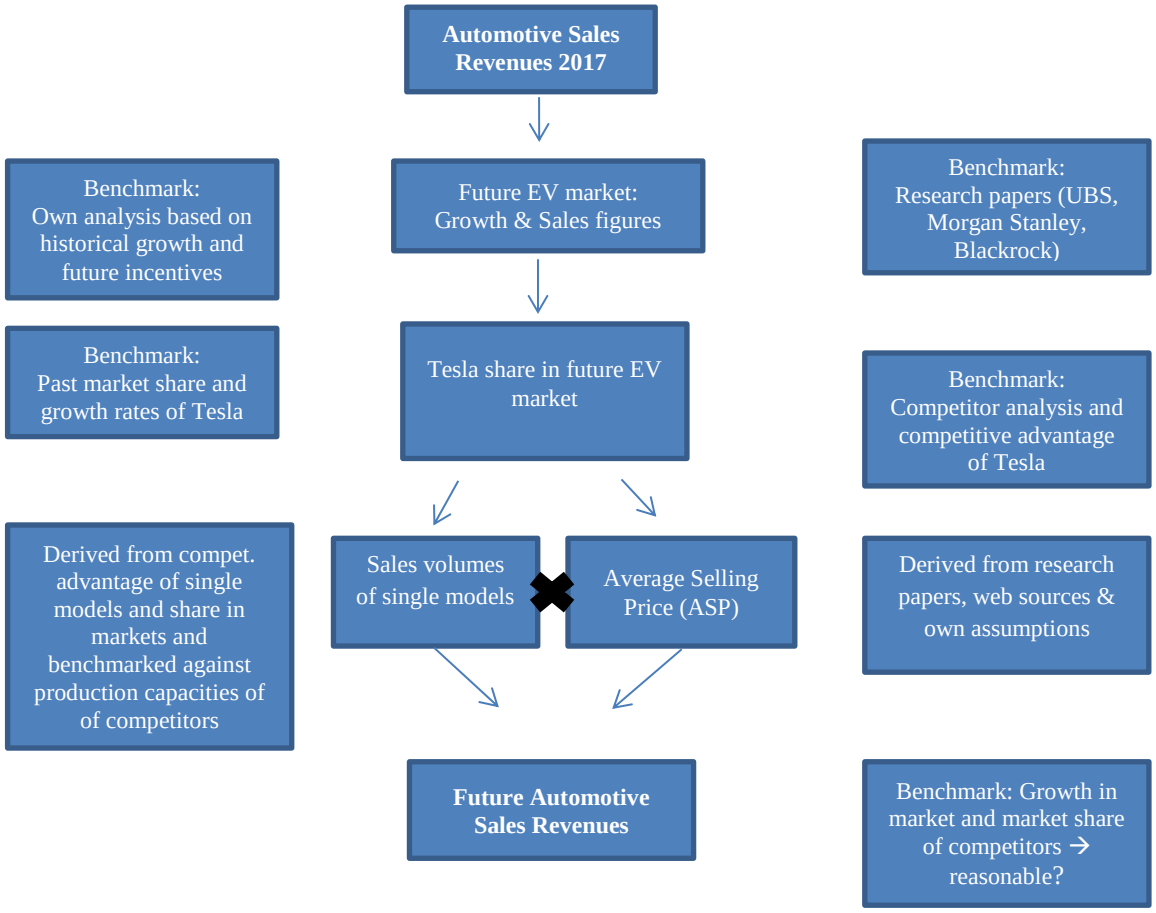
- Markets of operation;
- Size & growth of the overall markets → Car Market, EV Market & BEV market + Energy generation and storage market;
- Strength of competition → Current and future competition & competitive advantage;
- Quality of products and management → Business model & competitive advantage.

7.6.2 Principle of forecast technique for automotive sales

Automotive revenues can be separated into automotive sales and automotive leasing with putting a strong spotlight on automotive sales as it is the main sales driver of the company with a sales margin of 72,6% in 2017.

Automotive sales will be forecasted according to the subsequent illustration. This illustration will be applied for each model of Tesla which is already in production and which is planned to enter production within the upcoming years.

Table 29: Automotive sales revenue forecast – framework



7.6.3 Average selling price (ASP)

The average selling price describes the average price for which a specific model will be sold to its customer. This differs according to the model as each model is listed in a different car segment and price category. Additionally, it is assumed that the ASP is changing over time, also with regards to the research done by Blackrock "Future of the vehicle, Winners and losers: From cars and cameras to chips."

The research describes the shift in the car market from hardware driven automobiles to electric vehicles in combination with a strong level of connectivity, which will also affect future revenue sources and with it the revenue composition in the car market. The assumption is that recurring revenues will significantly increase making up more than one-fifth of automotive revenues until 2030 from more or less zero in 2017. Recurring revenues mainly refer to services of connectivity and content in the cars, such as software updates, entertainment and navigation.

According to the Blackrock research paper the entire auto market including connected market and secondary markets will increase the total amount of revenues from more than $3,5 trillion in 2016 to more than $6,5 trillion in 2030 which equals an compound annual growth rate of approximately 4,52%. This increase is mainly attributable to the described paradigm shift in the automobile industry turning cars more and more into high-tech multimedia vehicles with plenty of new ways of monetizing additional tech features in these vehicles. It is presumed that about 50% of this revenue increase will directly be reflected in an increase in revenues generated through the disposal and recurring items of the car as Tesla's annual report states that automotive sales revenues also include performances such as software updates or internet connectivity which are currently for free and therefore it will also include future updates that are assumed to be monetized. Consequently, the ASP of the single models will annually be increased by 2,26%, which equals 50% of the total revenue increase in the market according to the Blackrock research.

The assumptions start from the base average selling prices for 2017, which was estimated by summarizing and evaluating several articles by seekingalpha.com, electrek.co, UBS reports and further research articles of Blackrock and Morgan Stanley.

Table 30: Average selling price forecast per model

ASP, in $	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Model S	81.000	94.080	96.206	98.381	100.605	102.879	105.205	107.583	110.014	112.501	112.501
Model X	85.000	102.260	104.572	106.936	109.353	111.825	114.353	116.938	119.581	122.284	122.284
Model 3	43.000	53.230	43.972	44.966	45.982	47.022	48.085	49.172	50.283	51.420	51.420
Model Y					53.000	54.198	55.423	56.676	57.957	59.267	59.267
Semi-Truck						175.000	178.956	183.001	187.138	191.368	191.368
Roadster								205.000	209.634	214.373	214.373

Starting prices of new car and semi-truck introductions are based on announcements of Tesla, several research papers and reliable e-vehicle internet sources (electrek.co, ev-volumes.com).

7.6.4 Automotive sales forecast

After calculating the ASP for each model per year, the units sold will be estimated for each model to arrive at the total revenues generated by sales of the single models.

7.6.4.1 Model X

Table 31 illustrates the sales and revenue development of Tesla until 2027. Followed by the illustration, underlying assumptions and calculations are highlighted and explained.

Table 31: Model X sales volume and revenue forecast

Model X	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Sales units	**44.966**	**45.500**	**52.045**	**59.272**	**67.205**	**75.528**	**84.127**	**91.699**	**99.034**	**105.967**	**108.515**
%-yoy-growth	85,1%	1,2%	14,4%	13,9%	13,4%	12,4%	11,4%	9,0%	8,0%	7,0%	2,41%
%-m.tot. BEV sales	6,4%	4,0%	2,9%	2,1%	1,7%	1,4%	1,2%	1,0%	0,8%	0,6%	0,5%
%-m. tot. EV sales	3,7%	2,5%	2,0%	1,5%	1,2%	1,0%	0,8%	0,7%	0,6%	0,5%	0,4%
ASP (in $)	85.000	102.260	104.572	106.936	109.353	111.825	114.353	116.938	119.581	122.284	122.284
Revenues ($, mil.)	**3.822**	**4.653**	**5.442**	**6.338**	**7.349**	**8.446**	**9.620**	**10.723**	**11.843**	**12.958**	**13.270**

2018

Basis for the forecast of Model X for 2018 are the sales numbers from 2017. Tesla announced that for 2018 it expects comparable sales units as of 2017 with approximately 100.000 units sold of Model S and Model X. This assumption seems reasonable and the forecast even expects approximately 110.00 combined units sold of Model X and Model S in 2018 due to the following reasons:

- In 2018 still no strong competition and comparable cars on the E-SUV market → competitive advantages of Model X.

The competition and alternatives to the Model X in the E-SUV market remain low or not existing in 2018, solely the introduction of the Jaguar i-Pace can be seen as a direct competitor. Therefore the Model X is assumed to be still dominant in the market with the competitive advantages remaining strong.

- Strong growth of the overall SUV market.

Another aspect is that the overall SUV market is expected to grow strongly within the next years with a CAGR of around 11,4% between 2017 and 2023 according to the report "Global SUV Market – Competition Forecast & Opportunities" on reportlinker.com.

- Buyers of cheaper versions of the Model X are switching to Model 3→ no growth in sales units but strong growth in ASP in 2018.

The first two assumptions could even implicate a strong sales unit growth rate in 2018 which is on the other side offset by assumption 3. Assumption 3 seems reasonable, as the calculated ASP of Model X was

around $85.000 in 2017, which seems too low knowing that the cheapest version of the model starts at a sales price of $79.500 without any additional features.

To conclude revenue growth of the Model X in 2018 is not expect to come from an increase in sales units but from a strong increase in ASP.

2019 – 2027

The sales units of 2018 and the ASP are then used as the fundament for future estimations until assumed steady state in 2027 is reached. It is expected that until 2027 sales units of the Model X will reach approximately the sales of Audi's Q7, a direct competitor in the high-end SUV market, which showed 106.004 unit sales in 2017. Following assumptions are made for future growth between 2019 – 2027.

- Sales unit growth rates turn strong in 2019 due to vigorous SUV market growth in conjunction with EV further converging to cost parity compared to ICEs and tighter regulations on ICE in the future.

The growth in the SUV market remains strong until 2023 and afterwards converging to the growth rate of the overall passenger car market. Furthermore cost parities are approaching with the effect of higher sales in the future.

- Growing competition due to introductions of established car manufacturers and start-up companies like NIO or Byton.

Starting from 2019 – 2020 the competition in the entire EV market and also in the E-SUV market is expected to accelerate heavily. New introductions such as the NIO EP9, Porsche Mission E, Volvo E-XC 40, or the Mercedes ELC in conjunction with the overall EV-strategies of the companies will make the market significantly more competitive making it in turn more difficult to outperform the market and gain market share.

- Remaining but diminishing competitive advantages.

It is assumed that the competitive advantages of Tesla remain but diminish over time. However, especially their strong brand recognition and their vertical integration will also remain strong in the future with the first mover advantage losing its importance as the market grows rapidly. Established car manufacturers are also expected to add further additional features and modern designs to their cars which will diminish the advantage of superior technology and design as well.

In conclusion, sales growth is expected to accelerate strongly in 2019 due to strong overall demand for SUVs in combination with approaching of cost parities, less competition in the first years and

consequently stronger competitive advantages. However, these advantages will diminish over time letting the sales growth converging to the overall growth in the overall market. It is assumed that by that the Model X will be able to reach and slightly outperform the current sales rate of one of its direct competitor models, the Audi Q7, due to the reasons stated above. The Model X will then show a market share of 0,5% in the BEV market and 0,4% in the EV market, which seems reasonable, as these markets are still smaller than the overall passenger car market with these ratios expected to further converge to the market share of the Q7 of 0,15% due to stronger growth in the overall market compared to Tesla and convergence of the EV market sales to these overall passenger car market.

7.6.4.2 Model S

Main assumptions, which were valid for the forecast of the Model X sales volume, are also valid for Model S sales estimations, with minor adjustments. The table shows the development of sales and revenues over time, followed by the underlying assumptions/adjustments to Model X.

Table 32: Model S sales volume and revenue forecast

Model S	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Sales units	**53.978**	**56.000**	**59.988**	**64.079**	**68.001**	**71.823**	**75.501**	**78.989**	**82.244**	**84.811**	**86.850**
%-yoy-growth	6,4%	3,7%	7,1%	6,8%	6,1%	5,6%	5,1%	4,6%	4,1%	3,1%	2,41%
%-m.tot. BEV sales	7,7%	4,9%	3,4%	2,3%	1,8%	1,4%	1,1%	0,8%	0,6%	0,5%	0,4%
%-m. tot. EV sales	4,4%	3,1%	2,3%	1,6%	1,2%	1,0%	0,7%	0,6%	0,5%	0,4%	0,3%
ASP (in $)	81.000	94.080	96.207	98.381	100.605	102.879	105.205	107.583	110.015	112.502	112.502
Revenues ($, mil.)	**4.372**	**5.268**	**5.771**	**6.304**	**6.841**	**7.389**	**7.943**	**8.498**	**9.048**	**9.541**	**9.771**

Assumptions of the Model S growth in sales and revenues align with the assumptions of the Model X in many aspects. Therefore the following paragraph applies these main assumptions and adjusts it for the situation of Model S.

2018

According to Tesla's announcement in 2018 it also expects similar sales numbers from Model S, with the own forecast estimating 56.000 sold units as a consequence of the following assumptions:

- In 2018 still no strong competition and comparable cars on the E-SUV market → strong competitive advantages of Model S.

The competition for Model S is expected to be even lower than for the Model X as the Jaguar i-Pace is expected to be only a main competitor of Model X.

- Sedan market expected to align to the growth rate of the overall passenger car market of 1,12%.

However, the sedan market is assumed to grow with a significantly lower rate than the SUV market, however it is expected that at least in 2018 it will not heavily affect the sales numbers of the Model S.

- Buyers of cheaper versions of the Model S are switching to Model 3 but less than compared to Model X→ no growth in sales units but strong growth in ASP in 2018.

This assumption will be also reflected in the ASP of the Model S which increases by 16,1% to 94.080 in 2018 compared to an increase of 20,3% in the ASP of Model X in 2018. These assumptions seem reasonable as the increase in Model X's ASP is higher due to a higher substitution percentage compared to Model S. Consequently, the sales growth of Model S is expected to be slightly above the rate of Model X but with Model X having the bigger increase in ASP and the main driver of Model S in 2018 still being the increase in ASP.

2019 – 2027

The sales units of 2018 and its ASP will be applied for forecasts until 2027, the same approach as for Model X. The assumptions about future growth mainly stay the same with some small adjustments:

- Sales unit growth rates turn strong in 2019 due to vigorous growth in the EV and EV further converging to cost parity compared to ICEs and tighter regulations on ICE in the future. However, demand in the sedan market is significantly lower than in the SUV market → less demand for Model S compared to Model X.

The assumption of lower demand for Model S is also reflected in future sales growth numbers.

- Growing competition due to introductions of established car manufacturers and start-up companies like NIO or Byton.

The competition in the E-sedan market is expected to accelerate the same level as in the E-SUV market. New introductions such as the NIO EP9, the new electric C-Class from Mercedes, the i4 from BMW in conjunction with the overall EV-strategies of the companies will make the market significantly more competitive making it in turn more difficult to outperform the market and gain market share. The growing competition and the lower growth of the sedan market compared to the SUV market allowing the Model S to only grow with lower sales rates than the Model X. Therefore it is expected that by the latest by 2021 – 2022 sales volumes of Model X are outperforming these of the Model S and making the sales volume of Model S by 2027 20.000 units below the sales volume of Model X. This assumption also reflects the trend of other car manufacturers where SUV sales are outperforming these of the sedan market. Thus, the market share in the BEV and EV market will be slightly lower with 0,4% respectively 0,3%.

However, growing ASP over the years, assumed for all models of Tesla, still allow the revenue growth rate to be higher than the sales volume growth of all models.

7.6.4.3 Model 3

The approach for the Model 3 forecasts is a different one, as the demand for Model 3 significantly outpaces the supply provided by Tesla, therefore it is assumed that sales units are not based on demand but on supply, with sales unit estimations being mainly based on assumptions about future production capabilities of Tesla. This approach holds as it is assumed that demand will stay strong throughout the entire period. This assumption is backed by almost 500.000 pre-reservations of the Model 3 by the end of 2017.

Generally, precise forecasts are almost impossible to make for the Model 3. There is no history of sales, no pre-defined market which is growing with steady rates and no closest competitors where sales numbers could be derived from. Furthermore past promises made by Musk and Tesla regarding future production targets were almost constantly missed, thus not providing any reliance for reaching of future target rates.

Table 33 illustrates own assumptions based on different forecasts on seekingalpha.com, electrek.co, ev-volumes.com and several research papers on Tesla's way to reach its first production target of 500.000 Model 3 per year.

Table 33: Model 3 sales volume forecast

Sales Volume	2018	2019	2020	2021	2022	2023
Total	**137.680**	**263.000**	**344.500**	**416.000**	**468.000**	**510.120**
Q1	8.180	58.500	78.000	97.500	110.500	123.500
Q2	32.000	65.000	84.500	104.000	117.000	126.500
Q3	43.000	65.000	91.000	104.000	117.000	130.000
Q4	54.500	74.500	91.000	110.500	123.500	130.120

Tesla announced that it plans to produce 2.500 Model 3 by the end of Q1 2018 and 5.000 vehicles per week by the end of Q2 2018. Based on the past experience that production targets for Model 3 were constantly missed, own assumptions were adopted according to these fact.

It is assumed that Tesla will be able to reach 3.000 Model 3 per week by the end of Q2 2018 and 4.500 Model 3 by the end of Q4 2018. Tesla's production target of 5.000 Model 3 per week, which was announced for Q2 2018, will be reached by the end of Q1 2019, which is equal to an expected delay of nine month. By the end of 2019 an assumed per week production volume of 5.500 units will be reached, which will steadily increase to an overall production goal of 10.000 Model 3 per week which will be breached during the second quarter of 2023. This equals a delay of approximately two years, as Tesla announced 10.000 Model 3 per week for the middle of 2021. Thus these own assumptions seem rather conservative but based on past experience reasonable. The company stated that the maximum production amount of Model 3 in Gigafactory 1 lies by around 600.000 units per year, which will be reached by 2026.

It is assumed that by this point in time Tesla will already be finished with building up an additional factory for the production of Model 3, therefore sales are assumed to breach 600.000 units per year afterwards resulting in 621.275 units sold in 2027.

These own assumptions about sales units are reflected in the table 34, including the resulting growth rates and revenues.

Table 34: Model 3 sales volume and revenue forecast

Model 3	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Sales units	**137.680**	**263.000**	**344.500**	**416.000**	**468.000**	**510.120**	**548.379**	**581.282**	**606.642**	**621.275**
%-yoy-growth	7705,0%	91,0%	31,0%	20,8%	12,5%	9,0%	7,5%	6,0%	4,4%	2,41%
%-m.tot. BEV sales	12,0%	14,9%	12,4%	10,8%	9,0%	7,2%	5,8%	4,4%	3,6%	3,0%
%-m. tot. EV sales	7,7%	9,9%	8,5%	7,5%	6,2%	5,06%	4,13%	3,33%	2,76%	2,35%
ASP (in $)	53.230	43.972	44.966	45.982	47.022	48.085	49.172	50.283	51.420	51.420
Revenues ($, mil.)	**7.329**	**11.565**	**15.491**	**19.129**	**22.006**	**24.529**	**26.965**	**29.229**	**31.193**	**31.946**

According to reports, Tesla started the production of Model 3 by manufacturing the more expensive versions of Model 3, mainly due the probability of generating higher margins with these models. Therefore the ASP in 2018 is higher than the ASP starting in 2019 as for Q1 and Q2 an ASP of $55.000 and for Q3 and Q4 an ASP of $52.500 is assumed, which also corresponds with different reports. These underlying assumptions result in a weight of Model 3 revenues to overall automotive sales revenues of 38,4%, which seems reasonable according to goals of Tesla to break into the mass market with the Model 3. The sales volume of Model 3 in 2027 with 621.275 units sold lies in between the sales volume of the VW Golf with 867.145 vehicles sold in 2017 and the BMW 3 series with 409.005 vehicles sold in 2017, which are considered to be direct competitors of Model 3. However, the Model 3 is not assumed to be a car for the world mass market, as the ASP is too high, rather a car for the premium to upper-segment.

Factors like competition and competitive advantages also play an important role in the sales volume of Model 3. The underlying assumptions regarding these factors equal these of Model X, as this market is also assumed to have high growth potential in the future but also shows high future competition, especially from Chinese car manufacturers, which are offering very cheap alternatives and are striving to start exporting their vehicles worldwide by 2020. Nevertheless, as described above, it is assumed that the competitive advantages will shrink over time, but especially brand recognition and high-tech features will remain strong competitive advantages of Tesla over time, ensuring high future demand for Model 3. Additionally, the technology and software used in the Model 3, with its 15” screen in the middle of the cockpit, autonomous driving abilities and additional over-the-air software updates are features that are expected to keep the Model 3 competitive in the future. Consequently, despite the fact that the Model 3 is not assumed to be an alternative for the world mass car market due to its relatively high ASP, sales numbers of more than 600.000 by 2026 seem reasonable.

7.6.4.4 Model Y

The first model that is currently not in production but planned for future introduction is the Model Y. Official announcements of Tesla implied an introduction in 2019. However, the assumption of this thesis is that the delay of Model 3 production of approximately two years will also shift backwards the introduction of future models for approximately two years, including Model Y. Consequently, the assumed introduction date of Model Y will be middle/end of 2021. This assumption is also enforced by the fact that Tesla didn't release almost any information regarding technical features of Model Y and that no information are available on the official homepage of Tesla. Regarding sales units it is assumed that by 2026, after approximately six years of production, the sales volume will breach the sales volume of one of its direct competitor models, the BMW X3, which was sold 146.395 times in 2017. Nevertheless, the forecast of 152.743 units sold in 2027 is still below the target of Tesla, which announced 200.000 units after four to six years of production. The development of sales volumes as well as revenue growth is illustrated in table 35.

Table 35: Model Y sales volume and revenue forecast

Model Y	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**
Sales units	**27.500**	**57.750**	**92.400**	**110.880**	**130.838**	**149.156**	**152.743**
%-yoy-growth		110,00%	60,00%	20,00%	18,00%	14,00%	2,41%
%-m.tot. BEV sales	0,7%	1,1%	1,3%	1,2%	1,0%	0,9%	0,7%
%-m. tot. EV sales	0,5%	0,8%	0,9%	0,8%	0,7%	0,7%	0,6%
ASP (in $)	53.000	54.198	55.423	56.676	57.957	59.267	59.267
Revenues ($, mil.)	**1.458**	**3.130**	**5.121**	**6.284**	**7.583**	**8.840**	**9.053**

According to reports the ASP is assumed to be around $53.000, which is between the Model 3 and the Model X. It is assumed that the Model Y will combine features of Model 3 and Model X and with the listed competitive advantages of Tesla Model Y is assumed to reach the estimated sales volumes.

7.6.4.5 Semi-Truck

On the earnings call in 2017, Elon Musk said that "100.000 units a year is a reasonable expectation" for the sales volume of the Semi-Truck. "Maybe more, but that's the right – roughly number, I think." By also adding that he plans to reach this volume within four years Musk implied a production target of 100.00 units by 2022, given that the roll-out will work as planned by early 2019. Nevertheless the thesis expects the roll-out to start in the beginning of 2022 with 100.000 being reached by 2027, with production rates only partially increasing after that. These assumptions are modelled into the numbers below (table 36).

Table 36: Semi-Truck sales volume and revenue forecast

Semi-Truck	2022	2023	2024	2025	2026	2027
Sales units	**15.000**	**40.000**	**54.000**	**78.000**	**97.700**	**100.057**
%-yoy-growth		166,7%	35,0%	44,4%	25,3%	2,41%
%-m. tot. EV sales	0,2%	0,4%	0,4%	0,4%	0,4%	0,4%
%-m. com. Vehicle	0,1%	0,1%	0,2%	0,3%	0,3%	0,3%
ASP (in $)	175.000	178.956	183.001	187.138	191.368	191.368
Revenues ($, mil.)	**2.625**	**7.158**	**9.882**	**14.597**	**18.697**	**19.148**

The underlying assumptions for the described sales development are the following:

- Truck market sales with stable growth over the next years with an expected CAGR of 3,1% between 2017 and 2024 according to the Deloitte research paper "Truck Market 2024" and similar growth rates assumed afterwards.
- Given an assumed three year delay, Tesla will be able to set up a functioning production line without mature disruptions → straight increase in production capacity expected.
- Growing competition in the future → current strong competitors like Toyota, BYD, Daimler also with its brand Freightliner, Thor or MAN are also planning to introduce e-trucks within the next years.
- Given the current ASP of $120.000 for a class 8 truck, the category of the Tesla Semi-Truck, according to several articles on electrek.com and wired.com, Tesla's Semi is relatively expensive with an expected ASP of $175.000 in 2022 → But: If Tesla is able to manufacture the promised truck with its unique features, which were described in previous chapters, it will create strong competitive advantages in the truck market, making sales volumes of 100.000 units in 2027 reasonable, which converges to the sales volume of Daimler trucks for 2017 of 106.000 units sold. → It is assumed that due to three years delay and a step-by-step increase in production, this production target can be reached by 2026 -2027, making it possible for Tesla to serve the demand.

Given the assumptions and explanations above, a Semi-Truck sales volume of 100.000 units by 2027 seems reasonable, given that the company will be able to manufacture the truck with the unique features it promised during the presentation of the truck in November 2017.

7.6.4.6 Roadster

The new version of the Tesla Roadster is considered to be an interesting idea of Tesla, but due to main production problems it is assumed that the company will focus heavily on solving these problems by also trying to improve the manufacturing process in the future for future model introductions. Therefore no resources will be free to develop and manufacture the Tesla Roadster. However, as the model was already presented and reservations are already expected, it is assumed that Tesla will sell a very small amount of

these models just to prove that they would be able to manufacture them, but the main focus will be put strongly on the production and development of Tesla's other models. As a consequence it is assumed that only 40 Tesla Roadster will find their way to its customers with an ASP around $205.000 – $210.000.

Table 37: Roadster sales volume and revenue forecast

Roadster	**2024**	**2025**
Sales units	**20**	**20**
ASP (in $)	205.000	209.634
Revenues ($, mil.)	**4.100**	**4.193**

7.6.4.7 ZEV credit revenues

The disposal of zero-emission vehicle (ZEV) credits also account for automotive revenues of Tesla. The assumed future revenue development of the disposal of these credits is illustrated below.

Table 38: ZEV credit revenues forecast

Revenue ($, millions)	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**
ZEV credits	**400**	**420**	**430**	**435**	**435**	**326**	**218**	**109**	**0**	**0**

During the previous three years this revenue source steadily increased to $360,3 million in 2017. It is assumed that ZEV revenues further increase until its peak in 2021 – 2022 when most of the car manufacturers implemented main parts of their EV strategies, implying a lower demand for ZEV credits afterwards. As most manufacturers have long-term EV goals until 2025, it is assumed that 2025 will be the last year for major demand of ZEV credits, steadily converging to zero in 2026 from its peak in 2021/22.

7.6.4.8 Total automotive sales revenues and sales units

Total automotive sales represent the sum of the revenues out of the disposal of the single vehicle models including ZEV credit revenues. To ensure reasonability and plausibility of the single assumptions it is also important to check the overall development of automotive sales revenues in conjunction with total units sold.

Table 39: Total automotive sales volume and sales revenue forecast

Revenue ($, millions)	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	CAGR
Automotive sales	**17.650**	**23.198**	**28.563**	**35.211**	**44.031**	**54.698**	**66.669**	**76.601**	**81.229**	**83.187**	**25,6%**
%-yoy-growth	106,8%	31,4%	23,1%	23,3%	25,0%	24,2%	21,9%	14,9%	6,0%	2,4%	
%-m. tot. revenues	75,9%	74,5%	72,9%	71,4%	70,2%	69,7%	69,6%	69,5%	69,1%	69,1%	

Sales Units (in thsd.)	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	CAGR
Automotive Units	**239**	**375**	**468**	**579**	**688**	**802**	**884**	**971**	**1.044**	**1.069**	**18,1%**
%-yoy-growth	132,0%	56,8%	24,7%	23,7%	18,9%	16,6%	10,2%	9,9%	7,5%	2,4%	
%-m. BEV market	20,9%	21,2%	16,8%	15,0%	13,2%	11,3%	9,3%	7,4%	6,2%	5,1%	
%-m. EV market	13,4%	14,1%	11,6%	10,4%	9,2%	8,0%	6,7%	5,6%	4,8%	4,0%	

Firstly the development of Tesla's total automotive units sold will be put into a framework with other car manufacturers, with companies that are considered being Tesla's closest competitors in that field. It is assumed that Tesla will be able to sell more than one million cars by 2026, mainly due to a strong increase in sales of Model 3 and that the company will reach almost 1,07 million units sold in 2027. As the sales units of the single models were described and estimated reasonably, also the total sales units of Tesla should hold this assumption. Nevertheless a comparison of Tesla's expected sales units in 2027 to some of Tesla's its closest competitors' total sales units of 2017 will be conducted.

Table 40: Tesla sales volume forecast in comparison to competitors' sales volumes in 2017

Company	Sales Units 2017	Share in total car market 2017
Tesla (2027)	1.069.440	1,5%
BMW	2.463.526	3,5%
AUDI	1.878.105	2,7%
Daimler	2.289.344	3,2%

The numbers show that Tesla is only expected to sell approximately half of the cars that the three German premium brands were BMW, AUDI and Daimler (through Mercedes-Benz) were able to sell in 2017. However, this totally aligns with the assumptions made in this paper about the business model of Tesla as Tesla is not assumed to become a car producer for the mass market, rather a company providing high-tech cars and trucks for the upper-segment besides its strong energy business. Furthermore and more important for Tesla is the future share in the BEV and total EV market, which is assumed to be 5,1% respectively 4,0% in 2027. The sales share of Tesla in the markets is steadily decreasing due to strong growth rates of

the underlying markets and a growing competition. Moreover it is visible that the BEV and the EV market are converging to each other over time, implying that the battery market will squeeze out the hybrid technology in long-run, which is a positive aspect for Tesla. It is assumed that in the very long run, Tesla's market share will converge to approximately 2%, which is well below its competitors but which fully aligns to the overall assumptions for Tesla.

Automotive sales revenues are growing with a CAGR of 25,6% between 2017 – 2027. This is a reasonable assumption, knowing that Tesla is still considered a growth company and the expected heavy growth in the market of operation, the BEV market. Even though a CAGR of 25,6% is quite high, it is assumed, as the BEV market grows in terms of annual sale units with a CAGR of 40,5%, that despite this strong growth, Tesla will even slightly lose market share throughout the years. This assumption seems reasonable knowing that reaching high growth rates becomes more and more difficult the more mature the company is and also knowing that the competition is drastically growing within the next years.

In 2018 the %-yoy growth rate of 106,8% implies a doubling of sales revenues which is mainly attributable to the boost of Model 3 production and sales. During the years until 2022 or even 2023 the annual growth rates remain high and are slightly increasing in 2021 and 2022 due to the introductions of Model Y (2021) and the Tesla Semi (2022). Afterwards growth rates are further declining, converging to the overall growth in the economy, even though especially in 2023 the growth rates remains strong.

The margin of automotive sales revenues compared to total revenues of Tesla is slightly declining, which makes sense in that case that especially the energy storage segment is expected to outperform the automotive segment in terms of revenue growth rates in the upcoming years. This will be further described in the paragraph of energy generation and storage revenues. Nevertheless, with almost 70% of total revenues in 2027, the automotive segment is also expected to remain the most important sector for Tesla in the future.

7.6.5 Automotive leasing revenues

As described in the revenue recognition chapter, leasing revenues can comprise direct leasing programs, sale-back possibilities for both private customers and leasing partners, and others. However, it is almost impossible to estimate automotive leasing revenues in the future. The only fundament which might be helpful for future estimations are past developments, also in the framework of comparison to automotive and total sales of Tesla.

Table 41: Automotive leasing revenue analysis

Revenues ($, million)	2015	2016	2017
Total Revenues	**4.046**	**7.000**	**11.759**
%-yoy-growth	26,5%	73,0%	68,0%
Automotive sales	**3.432**	**5.589**	**8.535**
%-yoy-growth	19,4%	62,9%	52,7%
Automotive leasing	**309**	**762**	**1.107**
%-yoy-growth	133,4%	146,2%	45,3%
%-m. tot. revenues	7,6%	10,9%	9,4%
%-m. autom. Revenues	9,02%	13,63%	12,97%

The numbers show that the growth rate of leasing for 2015 and 2016 was significantly higher than for total and automotive revenues, whereas in 2017 the growth rate turned out to be smaller. However, the only pattern might be that the development of yoy-growth goes in the same direction as total revenues and automotive revenues. This implies that instead of relying on yoy-growth numbers it might be better to keep automotive leasing revenues in an appropriate margin of total and automotive revenues. As automotive sales are more related to automotive leasing revenues instead of total revenues, as these revenues also include the energy sector, the %-margin of automotive revenues will be the fundament for future estimations. For this the average margin of the past three years was calculated which equals 11,87%. The estimations for the years 2018 – 2027 is illustrated in the table below.

Table 42: Automotive leasing revenue forecast

Revenues ($, millions)	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	CAGR
Automotive leasing	**2.095**	**2.704**	**3.339**	**4.128**	**5.175**	**6.454**	**7.888**	**9.080**	**9.642**	**9.874**	**24,5%**
%-yoy-growth	89,3%	29,1%	23,5%	23,6%	25,4%	24,7%	22,2%	15,1%	6,2%	2,41%	
%-m. tot. revenues	9,0%	8,8%	8,6%	8,4%	8,3%	8,3%	8,3%	8,2%	8,2%	8,2%	
%-m. autom. Revenues	11,87 %	11,87 %	11,87 %	11,87 %	11,87 %	11,87 %	11,87 %	11,87 %	11,87 %	11,87 %	

After estimating future development of Tesla's automotive segment, the thesis continues by estimating future revenues in Tesla's energy generation and storage segment.

7.6.6 Energy generation and storage revenues

Tesla is not just operating in the automotive sector, but is also considered being a strong player in the sectors of energy generation and especially energy storage.

Past growth rates, illustrated in table 43, show that also in the last years this segment grew much stronger compared to the automotive sector.

Table 43: Energy generation and storage revenue analysis

Revenues ($, million)	2015	2016	2017
Total Revenues	**4.046**	**7.000**	**11.759**
%-yoy-growth	26,5%	73,0%	68,0%
Automotive sales	**3.432**	**5.589**	**8.535**
%-yoy-growth	19,4%	62,9%	52,7%
Energy generation and storage	**14**	**181**	**1.116**
%-yoy-growth	244,0%	1153,0%	515,4%
%-m. tot. revenues	0,4%	2,6%	9,5%

The rates depict that the energy sector grew from an almost 0%-margin in 2015 to almost 10% within two years with revenues growing from $14 million to more than $1,1 billion. This is partially attributable to the growth in the energy generation sector and the acquisition of SolarCity and partially due to the latest large-scale arrangements and contracts of Tesla in the field of energy storage.

Tesla has already set up the world's largest battery in South Australia, a 129 MWh facility, together with the world's largest distributed power system, which is currently installed in cooperation with the French company Neoen. Besides these projects Tesla is currently into work to integrate several more projects in Australia:

- 6 MW project in Adelaide
- 25 MW / 50 MWh battery project in Victoria
- Many more projects for Tesla are expected in Australia, as the state estimates that by 2040 50% of all power supply to come from distributed generation

Additionally, Tesla received several orders from around the world during the last years, including:

- Future projects in Puerto Rico awaited after successful installation of energy storage products after hurricane → discussions to replace of the grid's capacity with 4164 MW solar plant → equals $8,22 billion
- Supply of 212 KW battery to one BP wind farm → BP has 13 of these windfarms so future projects can be expected

- Set up Powerpack systems for Con Edison, New York's largest electric utility company, worth $5,6 million

GTM research expects deployments of energy systems to increase from 431 MWh to 1233 MWh in 2018, which equals a yoy-growth rate of 186% with further growth to approximately 9.400 MWh in 2023, which equals a '17 – '23 CAGR of 67%. According to the research, lithium-ion batteries held a 98,8% market share in Q4 2017 thus Tesla currently providing the technology of choice. Similar developments are expected worldwide.

Tesla takes up this topic in its Q4 shareholder letter as it expects growth to triple in this sector in 2018, which would "in fact only keep pace with the general rate of growth of the industry in the USA." (Cox, 2018)

Thus, the main growth drivers for Tesla in this sector are the increasing demand in the market and the growing amount of projects granted to Tesla that are expected to continue in the future. The estimated future revenues and growth rates are illustrated in table 44:

Table 44: Energy generation and storage revenue forecast

Revenues ($, millions)	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	CAGR
Energy storage & generation	**1.842**	**2.947**	**4.420**	**6.410**	**8.973**	**11.665**	**14.360**	**16.688**	**18.241**	**18.679**	**32,5%**
%-yoy-growth	65,0%	60,0%	50,0%	45,0%	40,0%	30,0%	23,1%	16,2%	9,3%	2,41%	
%-m. tot. revenues	7,9%	9,6%	11,4%	13,1%	14,4%	14,9%	15,0%	15,1%	15,5%	15,5%	

It is important to mention that MWh growth in the market cannot be converted 1-on-1 into revenue growth. This is mainly due to the fact that during the last few years the cost of energy production and storage become significantly cheaper, with the trend expected to continue in the future. Nevertheless, it is assumed that revenue growth rates of remain strong in the years until 2022 – 2023, as the demand is expected to increase strongly, partially also due to these sunk costs.

Major players and competitors of Tesla in the energy storage market are ABB, LG Chem, Hitachi, AES and Ameresco and with SunPower, Sunrun, Solaredge, First Solar and JA Solar being direct competitors in the energy generation market.

A further assumption is that also in the upcoming years revenue growth of this sector will outperform the automotive sector but start converging to automotive revenue growth figures to ensure a stable margin in perpetuity. This also includes the fact that Tesla is stronger concentrating on profitability in the sector of solar energy production instead of growth in future years and it is expected that especially in the energy storage segment the competition will grow significantly within the next years. Consequently, the energy

sector is assumed converging to a total sales margin of approximately 15% in 2027 from around 10% in year 2017.

7.6.7 Services and other revenues

Service and other revenues mainly reflect repair and maintenance services, sales of used Tesla vehicles and sales of electric vehicle and powertrain components and systems to other manufacturers. There is no actual operating market which can be used as a benchmark for future growth and also reliance on past growth can bear too big deviations in the future as the numbers and growth directions differ strongly from total revenue growth measures as well as from the other sectors.

Table 45: Service and other revenue analysis

Revenues ($, million)	2015	2016	2017
Total Revenues	**4.046**	**7.000**	**11.759**
%-yoy-growth	26,5%	73,0%	68,0%
Services and other	**291**	**468**	**1.001**
%-yoy-growth	55,3%	61,1%	113,9%
%-m. tot. revenues	7,2%	6,7%	8,5%

Therefore the same approach as for automotive leasing was used by calculating the average %-margin of total revenues which equals 7,5% for services and other. As it is assumed that reparations and maintenance might become a smaller percentage in the future due to technological improvements and more people getting used to technologies of Tesla the target margin will be slightly below 7,5% with a target margin of 7,1% to which the current margin is converging. The development of future services and other revenues converging to the target margin of 7,1% is shown below.

Table 46: Service and other revenue forecast

Revenues ($, millions)	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	CAGR
Services & other	**1.702**	**2.298**	**2.872**	**3.590**	**4.489**	**5.577**	**6.798**	**7.810**	**8.282**	**8.481**	**23,8%**
%-yoy-growth	70,0%	35,0%	25,0%	25,0%	25,4%	24,7%	22,2%	15,1%	6,2%	2,41%	
%-m. tot. revenues	7,3%	7,4%	7,3%	7,3%	7,2%	7,2%	7,2%	7,2%	7,1%	7,1%	

7.6.8 Total revenues and total sales units

All these assumptions and forecasts will lead to total revenues for the years 2018 – 2027 which are depicted in table 47. Revenues are forecasted as they serve as the fundament for the DCF valuation of Tesla.

Table 47: Total revenue forecast

Revenues ($, mil.)	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	CAGR
Total Revenues	**23.289**	**31.617**	**39.676**	**49.826**	**63.156**	**78.759**	**95.959**	**110.300**	**117.395**	**120.221**	**26,2%**
%-yoy-growth	98,1%	35,8%	25,5%	25,6%	26,8%	24,7%	21,8%	14,9%	6,4%	2,41%	
Automotive sales	**17.650**	**23.198**	**28.563**	**35.211**	**44.031**	**54.698**	**66.669**	**76.601**	**81.229**	**83.187**	**25,6%**
%-yoy-growth	106,8%	31,4%	23,1%	23,3%	25,0%	24,2%	21,9%	14,9%	6,0%	2,4%	
Automotive leasing	**2.095**	**2.704**	**3.339**	**4.128**	**5.175**	**6.454**	**7.888**	**9.080**	**9.642**	**9.874**	**24,5%**
%-yoy-growth	89,3%	29,1%	23,5%	23,6%	25,4%	24,7%	22,2%	15,1%	6,2%	2,41%	
Energy st. & gener.	**1.842**	**2.947**	**4.420**	**6.410**	**8.973**	**11.665**	**14.360**	**16.688**	**18.241**	**18.679**	**32,5%**
%-yoy-growth	65,0%	60,0%	50,0%	45,0%	40,0%	30,0%	23,1%	16,2%	9,3%	2,41%	
Services & other	**1.702**	**2.298**	**2.872**	**3.590**	**4.489**	**5.577**	**6.798**	**7.810**	**8.282**	**8.481**	**23,8%**
%-yoy-growth	70,0%	35,0%	25,0%	25,0%	25,4%	24,7%	22,2%	15,1%	6,2%	2,41%	

It is visible that until 2022 the annual revenue growth rate is constantly higher than 25%, which corresponds to the assumption of a high growth period of Tesla for the next five years. Especially in 2018 revenues are expected to almost double, mainly due to the huge ramp-up in Model 3 production and delivery of the higher priced versions and a continuing strong growth in the energy storage sector. High growth rates will be sustained until 2022 due to strong growth in the energy sector, further ramp-up of Model 3 production and the introductions of Model Y and Semi-Truck in 2021 respectively 2022. Afterwards the growth rates starts converging to its perpetuity growth rate of 2,41%, which equals the current risk-free rate, the growth rate of the total economy in long-run.

Subsequently, Tesla's target revenues in 2027 are compared to the 2017 revenues of its closest competitors in the car market.

Table 48: Tesla total and automotive revenue forecast in comparison to competitors' revenues in 2017

Company	Revenues 2017 ($, in millions)
Tesla Total Revenues (2027)	120.221
Tesla Automotive Revenues (2027)	93.061
BMW	111.479
AUDI	67.928
Daimler	185.648
Mercedes-Benz	113.165

Tesla's total target revenues in 2027 exceed these of BMW, AUDI and Mercedes-Benz. This is especially interesting as it is assumed that Tesla will only sell approximately half the amount of cars compared to its competitors. However, by only looking at pure automotive revenues it shows that Tesla still lacks in

revenues compared to its competitors but significantly less than the difference in automotive sales units would imply. As a consequence it is possible to conclude that the average sales prices of Tesla exceed these of its competitors, confirming the assumption of Tesla being located in the upper-segment of the car market, even with its Model 3. The fact that total revenues of Tesla outperform is therefore attributable to Tesla's strongly growing energy business and therefore to the superior business model and its vertical integration. Both revenue estimations of Tesla for 2027, total revenues and automotive revenues, seem reasonable as they fully align to the assumptions made beforehand. Tesla's automotive revenues still lack these of its competitors due to its significantly lower sales volumes, but the higher ASPs significantly decrease this gap. That Tesla's total revenues still exceed these of its competitors in the car market is also attributable to the company's strong energy segment and its superior business model, providing significant and sustainable competitive advantages, which are converted into superior revenues.

7.7 Operating profit margin

The operating profit margin is an important measure of profitability. Operating profit, also called EBIT, provides the basis for the calculation of the net operating profit/loss less adjusted taxes (NOPLAT) in the DCF model.

On the one hand operating profit can be calculated by subtracting all cost of revenues and operating costs from revenues to arrive at operating profit. However, this approach, especially for a growth company like Tesla, is linked with high uncertainties about future developments of these positions.

On the other hand the second possibility is to calculate the current operating profit margin and converging the company's current operating margin to its target operating profit margin in steady state over time by looking at margins commanded by larger, more stable firms in that industry (Damodaran, 2010).

The target operating profit margin of Tesla is based on peer companies operating profit margins in 2017 in the sectors, in which Tesla is operating or assumed to derive its margins from. These sectors are assumed to be the automotive sector, energy storage sector, energy generation sector and the software/internet media sector. The software sector is included as the business model of Tesla is based on a high application rate of software in all of its sectors of operation, which is even expected to increase in the future. Therefore future margins are also partially determined by this influence. The choice of peer companies in the automotive sector is based on the competitive analysis conducted earlier in this work and peer companies in the remaining sectors were picked after extensive research in the underlying sectors with data retrieved from Bloomberg.

For all sectors the average operating margin, the median and underlying quantiles were calculated with results shown in table 49.

Table 49: Peer companies' operating profit margins

Automotive	Op.margin
BMW	9,92%
VW	6,73%
AUDI	9,09%
Geely	13,09%
BYD	8,12%
BAIC	13,90%
GM	7,53%
Renault	6,76%
Daimler	7,85%
Volvo	9,44%
Toyota	7,34%
Average	9,07%
Median	8,12%
80%-Quantile	9,92%
90%-Quantile	13,09%

Software/Internet Media	Op. margin
Alphabet	23,59%
Baidu	18,50%
Alibaba	30,36%
Facebook	49,70%
Average	30,54%
Median	26,98%
80%-Quantile	38,10%
90%-Quantile	43,90%

Energy storage	Op. margin
AES	21,36%
ABB	10,01%
LG Chem	11,40%
Hitachi	5,91%
Ameresco	5,10%
Average	10,76%
Median	10,01%
80%-Quantile	13,39%
90%-Quantile	17,38%

Energy generation	Op. margin
Sunpower	-54,41%
Sunrun	-34,40%
Solaredge	15,00%
First Solar	13,78%
JA Solar	3,64%
Average	-11,28%
Median	3,64%
70%-Quantile	11,75%
80%-Quantile	14,02%

For the software/internet media sector it was decided to take the median as the benchmark for Tesla, as this sector is not Tesla's main field of operation, therefore rather a medium value was selected not to over- or underestimate the operating margin. The energy storage business, which is one of Tesla's major sectors of focus, is expected to reach the 90%-quantile of operating margins. This assumption is underlined by successfully installed projects in the past, the high amount of projects granted to Tesla, implying that firms and governments prefer Tesla over other companies implying competitive advantages of Tesla also in this sector and the vertically integration of Tesla, resulting in cost advantages also for the energy storage segment. The energy generation sector however is assumed to be less profitable, which is shown by negative operating margins of several competitors. Consequently, in this segment only the 70%-quantile was used, even though Tesla was announcing that its energy generation sector will focus more on increasing profitability in the future.

The automotive segment shows especially high operating margins for Chinese car manufacturers, which is assumed not to be realistic for Tesla in the long-run. Nevertheless, the 80%-quantile was selected as the most reasonable target operating margin as already analyzed Tesla has strong competitive advantages over its competitors and will gain more market share from them over the future, implying operating margins in the upper region of its competitors. With a target operating margin in the automotive sector of 9,92% Tesla is assumed to reach the operating margin of BMW in 2017, which seems reasonable after previous analysis.

To receive the total target operating margin of Tesla, the sector margins need to be weighted according to their influence and importance for the business model and profitability of Tesla. The weights mainly comply with the margins of total revenues. The energy sector was split to two-third into energy storage and one-third into energy generation as the energy storage business is considered to be more important

and will have a higher impact on Tesla. As the software margin is assumed to influence both, the automotive and the energy sector, its weight will be the same as the entire energy sector. This leads to the following weights and target operating margin of Tesla:

Table 50: Target operating profit margin Tesla

Sector	Operating Margin	Weight	Quantile
Automotive	9,92%	0,7	80%-Quantile
Software	26,98%	0,15	Median
Energy Storage	17,38%	0,1	90%-Quantile
Energy Generation	11,75%	0,05	70%-Quantile
Total	**13,32%**		

This target operating margin will be reached in 2027, with the current margin converging to it. This process and the underlying operating profits or losses for the single years are shown below, starting from an adjusted operating margin of -7,3% in 2017.

Table 51: Annual operating profit/loss Tesla over time

Revenues ($, mil.)	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Total Revenues	**11.759**	**23.289**	**31.617**	**39.676**	**49.826**	**63.156**	**78.759**	**95.959**	**110.300**	**117.395**	**120.221**
Operating margin	-7,3%	-5,2%	-3,1%	-1,1%	1,0%	3,0%	5,1%	7,1%	9,2%	11,3%	13,3%
Op. profit/loss	**-853**	**-1.210**	**-992**	**-429**	**486**	**1.915**	**4.008**	**6.857**	**10.150**	**13.217**	**16.008**

The calculation shows that Tesla currently accounts for losses on the EBIT level and it is expected to do so until 2021, when it breaks even on the EBIT – level for the first time. Knowing that Tesla is still considered a growth company and is expected to stay a growth company for the next years with all the described characteristics, this assumption seems reasonable. The point in time of break – even also corresponds with the introduction of Model Y and is expected to be one year before the phase of high growth declines with the revenue growth rate starting to converge to the perpetuity growth rate. This assumption is reasonable as phases of high growth usually come with lower margins and phases of profitability improvement usually come with lower growth. This is what specifically happens after 2022 when revenue growth declines and the profitability margin further converges to the target margin until 2027. With an total operating margin of 13,3% Tesla is considered to be able to outperform most of its competitors in the car market related to profitability on the EBIT level.

The UBS report "Electric Car Teardown – Disruption Ahead?" provides a breakdown of costs of the Model 3, also compared to the competitive model of BMW, the 330i. The Model 3 is considered the way to success for Tesla. Therefore a closer look will be taken into revenues and costs of the model to arrive at a reasonable gross margin for the Model 3.It is assumed that if Model 3 will be able to reach the operating margin of the combined automotive and software margin, as it is assumed that both will affect future

operating margins in car models, it is a further confirmation of reasonability of the assumptions made above. The target operating margin of the automotive segment of 9,92% combined with the software operating margin and its underlying weights yield a profit margin of 12,93%. Table 52 firstly provides a model breakdown of the BMW i330 done by UBS, followed by the Model 3 breakdown of UBS including UBS' own assumptions and the breakdown of Model 3 based on own assumptions.

Table 52: Model 3 tear-down in comparison to BMW 330i

Description	BMW 330i	Model 3	Model 3 (own assumptions)	Comments / Assumptions
	w/ options	w/ options	w/ options	
ASP	**45.000**	**42.000**	**51.420**	According to UBS and market consensus – comparison to i330
Dealer/incentives (15%)	5.870	-	-	
Price charged by OEM	**39.130**	**42.000**	**51.420**	
Battery cost ($/kWh)		165	133	~$133/kWh announced by Tesla
kWh		55	55	
Battery cost ($, total)		**9.075**	**7.315**	
Powertrain cost	**8.500**	**4.503**	**4.503**	
Warranty provision	783	1.700	2.040	Half of Model S initial accrual
Direct assembly staff cost	2.800	2.400	3.400	
Direct materials	1.800	2.200	4.092	Higher due to aluminium
Supplier components	10.400	10.000	10.000	Less luxury content but more ADAS tech than BMW 3-Series
Optional features	3.125	3.500	4.926	Est. 50% contribution on option; own assumption 82%
Gross/Contribution margin	**11.723**	**8.622**	**15.144**	
% margin	30%	21%	29,5%	
D&A	1.685	3.000	3.000	Higher due to Gigafactory
D&A % of sales	4%	7%	6%	
R&D	1.685	952	1500	
R&D % of sales	4%	2%	3%	
SG&A	2.965	4.000	4.000	+$2k for dealer -$1k for advertising
SG&A % of sales	8%	10%	8%	
EBIT	**5.388**	**670**	**6.644**	
EBIT margin	14%	2%	12,92%	

Adjustments in the calculation were conducted based on additionally revealed information and on own assumptions. The adjustments are listed below:

- ASP was adjusted to the estimated ASP of Model 3 for 2027.
- Battery costs per kWh were adjusted to $133/kWh, which aligns with Tesla's current announcements of production costs and these costs are highly probable to even further decrease until 2027.
- Warranty provisions were increased to reflect the latest developments in this segment.
- Due to the decrease in automation of Model 3 assembly, direct assembly staff costs are expected to increase by $1.000.

- It is assumed that due to higher demand in the future the costs for direct materials will further increase.
- R&D costs are also expected to increase in the future as a consequence of the latest announcements of Tesla to invest strongly into R&D in the future.
- The assumption of a 50% gross margin on options looks too bearish, which will therefore be adjusted to a rate of 82%. This rate was calculated by assuming that $5.000 out of the $7.000 of additional options is generated by software upgrades with a gross margin of 95% as the hardware is already in place assuming that 62,5% of Model 3 buyers upgrade with the enhanced autopilot option and these buyers also purchase the full self-driving capability. The bias that not all customers which are buying the one option also decide to purchase the other option is offset by the low rate of upgraders of only 62,5%, as different surveys show acceptance rates between 67%-80%. The missing $2.000 is related to hardware upgrades with a gross margin of 50% (like UBS). This results in a gross margin for additional options of 82%.
- According to Musk, once some actual functionality is offered, the price of the fully autonomous driving option will further increase. This information is not incorporated which theoretically might increase the operating margin further.

Even though the own adjustments are considered to be rather conservative, according to the calculations above the Tesla Model 3 will still be able to achieve an EBIT-margin of 12,92%. Assuming that more expensive models, like the Model S or Model X, usually yield higher profit margins is further evidence that the assumptions conducted regarding Tesla's target operating margin are plausible.

7.8 Tax rate

In 2017 the U.S. government has enacted the law to reduce the federal tax rate to 21% by the beginning of 2018, The next step in calculating free cash flows to the firm is to calculate the net operating profit less adjusted taxes (NOPLAT or EBIT (1-t)), by subtracting marginal tax effects from the operating margin. It is important to mention that in case of negative EBITs, no taxes are charged and the loss will be carried forward, meaning future positive operating profits can be offset by these net operating losses (NOL) carried forward. The underlying calculations of calculating NOPLAT and NOL are illustrated in table 53.

Table 53: Annual NOPLAT of Tesla over time

NOPLAT ($, mil.)	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Operating income	**-853**	**-1.210**	**-992**	**-429**	**486**	**1.915**	**4.008**	**6.857**	**10.150**	**13.217**	**16.008**
- Tax Rate (21%)	35,0%	21,0%	21,0%	21,0%	21,0%	21,0%	21,0%	21,0%	21,0%	21,0%	21,0%
= NOPLAT	**-853**	**-1.210**	**-992**	**-429**	**486**	**1.915**	**4.008**	**6.857**	**8.238**	**10.442**	**12.646**
NOL carry forward	11.680	12.890	13.882	14.311	13.825	11.910	7.902	1.045	0	0	0

The statutory tax rate is used as the tax rate of computing the NOPLAT for Tesla. At the end of 2017 Tesla accounted for a total NOL carried forward of $11,68 billion, which will further increase to $14,311 billion by the end of 2020 until the company turns profitable in 2021. The company is expected to start paying taxes by 2025 when the entire NOL carry forwards are offset by taxable income, after four years of positive operating income.

7.9 Reinvestment needs

The NOPLAT provides the basis for the calculation of the FCFF. In general two approaches can be applied to calculate FCFFs out of NOPLAT.

However, according to Damodaran only taking net capital expenditures and working capital changes from most recent years, especially for growth companies, "and assuming that these items will grow at the same rate as revenues can result in reinvestment numbers that are both unrealistic and inconsistent with assumptions about growth" (Damodaran, 2010, p. 284). This argument also refers to the fact described in the theoretical part that investment decisions are based on expectations about future cash flows and the relationship between past growth rates and future growth of growing companies is considered very weak.

Thus, the reinvestment rate will be used as it describes the needs of reinvestment the firm has to prosecute in order to generate the growth of the company. This approach also ensures internal consistency with growth assumptions that are not achieved by the first approach. The reinvestment rate is calculated the following:

$$\text{Reinvestment Rate} = \frac{\text{Revenues}_t - \text{Revenues}_{t-1}}{(\frac{\text{Sales}}{\text{Capital}})\text{Ratio}}$$

$$\text{And the sales-to-capital ratio} = \frac{\text{Revenues}_t}{\text{BV Total Debt}_t + \text{BV Equity}_t - \text{Cash and Cash Equivalents}_t}$$

The sales-to-capital ratio explains how efficiently capital is used to generate revenues with a higher ratio implying higher efficiency.

Firstly, the sales-to-capital ratio of Tesla is calculated for the year 2017, illustrated in table 54.

Table 54: Sales-to-capital ratio Tesla 2017

Sales / Capital	**2017 ($, in millions)**
Revenues	11.759
/ (BV Total Debt	10.215
+ BV Total Equity	5.632
- Cash & Cash Equiv.)	3.368
= Sales / Capital (2017)	**0,94**

Afterwards the same approach was used as for the operating margin calculation. The sales-to-capital ratio of the located peer companies was calculated by applying the same calculation method as for Tesla. The underlying quantiles or medians of the sales-to-capital rate of the sectors are then calculated and the target sales-to-capital ratio of Tesla is determined based on these quantiles or medians sales-to-capital ratio of the sectors and weights used in the operating margin computation, also to ensure consistency in the underlying assumptions. Subsequently, the sales-to-capital ratio of Tesla for 2017 is modelled to converge to the computed target ratio in 2027's steady state. The calculations of the sales-to-capital ratios for the single companies can be found in the tables 5 – 8 of the appendix.

After determining the single sales-to-capital ratios of peer companies, the quantiles/median were calculated by using the assumptions of the target operating profit margin computation. These ratios were used for two reasons:

1. Sales-to-capital ratio also refers to efficiency and profitability of the company.
2. Ensure internal consistency in assumptions.

Table 55: Sales-to-capital ratio peer companies

Automotive	**Sales / Capital**
BMW	0,67
VW	0,91
AUDI	3,49
Geely	3,77
BYD	0,92
BAIC	2,37
GM	1,31
Renault	0,79
Daimler	1,04
Volvo	1,60
Toyota	0,86
Average	1,61
Median	1,04
80% - Quantile	**2,37**

Internet Media	**Sales / Capital**
Alphabet	2,03
BAIDU	-0,19
Alibaba	0,60
Facebook	1,25
Average	0,92
Median	**0,92**

Energy Storage	**Sales / Capital**
AES	0,43
ABB	2,00
LG Chem	1,42
Hitachi	2,09
Ameresco	1,38
Average	1,46
Median	1,42
90% - Quantile	**2,05**

Energy Generation	**Sales / Capital**
SunPower	1,31
Sunrun	0,25
Solaredge	3,87
FirstSolar	1,17
JASolar	1,68
Average	1,66
Median	1,31
70% - Quantile	**1,61**

Out of these sales-to-capital ratios the target ratio for Tesla was derived by applying the weights used for computing the target operating profit margin of Tesla, also to ensure consistency in the underlying assumptions.

Table 56: Target sales-to-capital ratio Tesla

Sector	Sales / Capital	Weights	Quantiles
Automotive	2,37	0,70	80% - Quantile
Internet Media	0,92	0,15	Median
Energy Storage	2,05	0,10	90% - Quantile
Energy Generation	1,61	0,05	70% - Quantile
Target Sales / Capital Tesla	**2,09**		

Tesla's target sales-to-capital of 2,09 is even below the 80% - quantile of Tesla's peer companies in the automotive sector, implying that the target ratio is not overestimated.

After receiving the target sales-to-capital ratio of Tesla to which the current ratio will converge to, the annual change in total revenue, which equals the difference between current's and last year's revenues, and the sales-to-capital ratio of the underlying years then determine the reinvestment needs of the company for each year. The calculated reinvestment rate, which illustrates the reinvestment needs of the firm, is subtracted from the NOPLAT of the underlying years to receive the FCFFs for each year.

Table 57: Annual free cash flows to the firm of Tesla over time

FCFF ($, in millions)	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Revenues	**11.759**	**23.289**	**31.617**	**39.676**	**49.826**	**63.156**	**78.759**	**95.959**	**110.300**	**117.395**	**120.221**
EBIT (1-t)	-853	-1.210	-992	-429	486	1.915	4.008	6.857	8.238	10.442	12.646
- Reinvestment Rate		10.911	7.111	6.269	7.249	8.801	9.579	9.865	7.719	3.597	1.355
= FCFF		**-12.121**	**-8.103**	**-6.698**	**-6.763**	**-6.886**	**-5.571**	**-3.009**	**519**	**6.844**	**11.292**
Sales / Capital ratio	0,94	1,06	1,17	1,29	1,40	1,51	1,63	1,74	1,86	1,97	2,09

The calculations imply that the free cash flows of Tesla remain negative until 2024 and turn positive only afterwards. This is mainly attributable to the reason that even though the high growth period of Tesla phases out already in 2022 with revenue growth rates converging to the steady state growth rates afterwards, the growth is still high, especially in the following years of 2023 and 2024. To fund this high growth rates, according to internal consistency assumptions, further high reinvestment rates are needed which keeps the cash flows negative for the consecutive two years of 2023 and 2024. Consequently, investors can expect cash distributions such as dividends, not before 2025.

7.10 The discount rate – weighted average cost of capital (WACC)

After calculating free cash flows to the firm in the future, these cash flows have to be discounted back to the present by applying the WACC as the discount rate as described in the theoretical part.

7.10.1 Cost of debt

By the middle of 2017 there were major discussions about a downgrading of Tesla's credit rating from B2 to B3 with the highly probable outcome of a downgrading of Tesla. Consequently, it is assumed that starting from 2018 Tesla's credit rating equals B3, with consequences for Tesla's pre-tax cost of debt. For calculating the cost of debt the default spread of the company is determined based on their credit rating by using the default spread list of Damodaran, shown in table 9 of the appendix, and adding this result to the risk-free rate of Tesla.

Table 58: Tesla's cost of debt

Cost of Debt	2017	2018 – 2027
Rating	B2	B3
Underlying Default Spread	5%	6%
+ Risk-free rate	2,405%	2,405%
= Pre-tax Cost of Debt	**7,405%**	**8,405%**

The result shows that the expected downgrade of Tesla's credit rating increased the pre-tax cost of debt from 7,405% to 8,405%.

7.10.2 Cost of equity

The cost of equity in this thesis will be computed by applying the capital asset pricing model (CAPM). This approach is mostly used for valuation purposes and the formula is the following:

Cost of Equity (r_e) = Risk-free Rate + Levered Beta * Market Risk Premium

7.10.2.1 Risk-free rate

As the risk-free rate for the valuation of Tesla the 10-year U.S. treasury bond rate denominated in nominal terms was taken to ensure consistency as the valuation is conducted in nominal terms. The 10-year treasury bond of the U.S. was chosen as Tesla's residences lies in the U.S. and the U.S. Treasury bond is considered to be risk-free according to the criteria described in the theoretical part. The 10-year U.S. treasury bond rate as of 31st of December 2017 is 2,405%.

Risk-free rate = 2,405%

7.10.2.2 Market risk premium (MRP)

Data for the calculation of the MRP according to the description in the theoretical part are retrieved from Damodaran's database. Weights of the countries are based on the revenues generated in these countries according to the annual report of Tesla. Other countries, which are not further described by Tesla, are selected based on analysis of sales data retrieved from electrek.co and then weighted accordingly.

Table 59: Market risk premium

Country of Operation	Weights	MRP
U.S.	52,90%	5,08%
Norway	7,00%	5,08%
China	17,20%	5,89%
Other	22,90%	5,08%
Netherlands	25%	5,08%
Canada	25%	5,08%
Switzerland	25%	5,08%
Germany	25%	5,08%
Total MRP		**5,22%**

The calculation shows a total MRP of 5,22%, which is then used for the computation of the cost of equity of Tesla.

7.10.2.3 Bottom-up beta

The beta of Tesla, which describes "the risk that an investment adds to a market portfolio," (Damodaran, 2012, p.183) is determined by applying the bottom-up beta approach describe previously. Firstly the businesses of operation and their weights are set equal these used before, including calculations of operating profit margin and sales-to-capital ratio. Identical peer companies are used from which the historical betas were retrieved from Bloomberg from the period 2015 – 2017, measured against their listed indices.

Table 60: Historical betas peer companies

Automotive	Hist. beta
BMW	1,414
VW	1,121
AUDI	0,165
Geely	1,686
BYD	1,367
BAIC	0,831
GM	1,686
Renault	1,352
Daimler	1,243
Volvo	1,268
Toyota	1,054
Average	1,20
Median	**1,27**

Internet Media	Hist. beta
Alphabet	1,243
BAIDU	1,441
Alibaba	1,173
Facebook	1,132
Average	1,247
Median	1,208

Energy Storage	Hist. beta
AES	0,851
ABB	0,941
LG Chem	1,462
Hitachi	1,273
Ameresco	1,720
Average	1,249
Median	**1,273**

Energy Generation	Hist. beta
SunPower	2,815
Sunrun	2,818
Solaredge	1,562
FirstSolar	1,743
JASolar	1,226
Average	2,03
Median	1,74

From these calculations the median was taken as the reference levered beta of the peer companies, which is then unlevered using the median market D/E ratio of peer companies based on market values of debt and equity in the underlying sectors and by multiplying these unlevered beta with the sector weights, the total unlevered beta of Tesla is obtained. The calculation of the unlevered beta for Tesla is based on D/(D+E) and D/E ratios of the selected peer companies and the calculation of the average and median market D/E ratios of the sectors, which can be found in table 10 and table 11 of the appendix together with calculations of market D/(D+E) ratios in the single sectors.

Table 61: Target D/E ratio, target D/(D+E) ratio and unlevered beta of Tesla

Sector	Median Market D/E	Unlevered Beta	Weights
Automotive	0,92	0,79	0,7
Internet Media	0,027	1,19	0,15
Energy Storage	0,40	1,01	0,1
Energy Generation	1,36	0,92	0,05
Total / Target D/(D+E) & Unlev. Beta	**0,40**	**0,88**	
Total / Target D/E ratio	**0,66**		

The median of the weighted market D/(D+E) and D/E ratios of comparable peer companies in the sectors Tesla is operating in is also used in conjunction with the target D/(D+E) ratio Tesla is assumed to converge at.

7.10.2.4 Debt-to-equity ratio and total debt-to-total capital ratio Tesla

Following the current D/E and D/(D+E) ratios of Tesla are determined, based on market values of debt and equity in order to calculate the levered beta for Tesla and compared to the market average.

D/E ratios can be computed in two ways, either based on book values or on market values. Firstly the book value D/E ratio and afterwards the market value D/E ratio are calculated to show the difference between these two measures. For computing the WACC it is important to use market values as it reflects the current market situation and financial structure of the company more correctly in comparison to book values.

The market values of debt and equity are derived in the following ways:

1. Market value of equity is calculated by multiplying the number of shares outstanding with the share price as of 31st of December 2017. In case of other equity claims such as warrants and management options, these also have to be included. Therefore the number of fully diluted shares outstanding is multiplied by the share price as of 31st of December 2017and to this number is added the adjustment of R&D expenses. The market value of equity was already calculated in the R&D adjustment and can therefore be retrieved from there.

2. The market value of debt is calculated by treating the entire debt accounted on the books as one coupon bond, with a coupon set equal to the interest expenses on all the debt and the maturity set equal to the face-value weighted average maturity of debt (Damodaran, 2012) to obtain the current market value of debt.

With the formula for the coupon calculation being:

$$\text{MV of Debt} = \text{Annual Interest Expense} * \left(\frac{1 - \frac{1}{(1+\text{Current Cost of Debt})^{n}}}{\text{Current Cost of debt}} \right) + \frac{\text{BV Total Debt}}{(1+\text{Current Cost of Debt})^{n}}$$

With these market values the market D/E ratio of Tesla in 2017 can be calculated as illustrated in table 62.

Table 62: Current market D/E ratio of Tesla

D/E Ratios Tesla	$, in millions
Market Value of Debt (2017)	10.874
/ Market Value of Equity (2017)	57.961
= Market D/E Ratio (2017)	**0,19**
Book D/E Ratio (2017)	2,43
Target D/E ratio	**0,66**

It is assumed that Tesla's D/E over time is converging to the weighted median D/E ratio of Tesla's sector of operations as the company becomes more mature over time and is therefore assumed to move closer to sector figures. This assumption will also affect the following figures:

- Cost of equity: As the computation of the levered beta depends on the D/E ratio, the cost of equity will change with a changing D/E ratio.
- Cost of debt: As the company turns profitable and becomes mature and therefore financially more stable, it is assumed that the default spread will also decrease over time and therefore the cost of debt will decrease.
- WACC: As the cost of equity and cost of debt are changing over time, as well as the D/E ratio and with it the weights of debt and equity to total capital, the WACC will also change over time, which has to be considered in the computation of annual WACCs for Tesla over time. This also aligns to the underlying theory for the computation of WACC for Tesla, as changing discount rates are considered to be appropriate for growth companies as their financing mix and risk is changing over time.

Furthermore it should be mentioned that an interpolating of the optimal capital structure of Tesla results in a D/E ratio of 0,9 and a D/(D+E) ratio of 900%. Optimal capital structure is considered to be the capital structure which maximizes the value of the firm. This however does not seem reasonable in the case of

Tesla as the market value of debt is supposed to exceed the market value of equity nine-folded in a period of ten years, which would imply a total market value of debt of approximately $450 billion if compared to Tesla's current equity value. This does not seem reasonable for Tesla in 2027, also knowing that the current market value of Tesla's debt is only about $10,9 billion.

7.10.3 Calculation and development of weighted average cost of capital over time

The following chapter describes the influences and changes on the weighted average cost of capital for the period of 2018 – 2027, which serve as the discount rates of the underlying annual cash flows. Table 63 illustrates all figures related to the computation of the annual WACC over time.

Table 63: Annual WACC of Tesla over time

WACC	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
D/E	0,19	0,22	0,26	0,30	0,34	0,38	0,43	0,48	0,54	0,60	0,66
Weight of Debt	16%	18%	21%	23%	25%	28%	30%	33%	35%	37%	40%
Weight of Equity	84%	82%	79%	77%	75%	72%	70%	67%	65%	63%	60%
Levered Beta	1,05	1,08	1,11	1,14	1,18	1,22	1,26	1,30	1,25	1,29	1,34
Cost of Equity	7,86%	8,02%	8,19%	8,37%	8,56%	8,76%	8,98%	9,22%	8,95%	9,16%	9,39%
Pre-tax cost of debt	7,41%	8,33%	7,76%	7,18%	6,61%	6,03%	5,46%	4,88%	4,31%	3,73%	3,16%
Aft.-tax cost of debt	4,81%	6,58%	6,13%	5,67%	5,22%	4,76%	4,31%	3,86%	3,40%	2,95%	2,49%
WACC	**8,79%**	**9,08%**	**8,10%**	**8,10%**	**8,06%**	**8,01%**	**7,92%**	**7,80%**	**7,01%**	**6,84%**	**6,65%**

In the computation of the WACC it is of high importance that net operating losses (NOL) carried forward, which were accumulated by Tesla over time, have to be considered. NOL reduce the taxable income of the company. Tesla has revealed NOL in the amount of $11.680 million by the end of 2017. According to own forecasts this NOL will be depleted by the end of 2024, meaning the company starts paying taxes in 2025. This also has effects on the WACC, as the cost of debt is changed from pre-tax cost of debt to after-tax cost of debt due to valid application of the tax shield by 2025 and the tax shield will also be included in the calculation of the levered beta.

7.10.3.1 Development of weights of debt and equity over time

It is assumed that the weights of debt and equity are converging to the market median over time. It implies that Tesla will take on additional debt in relation to its market value of equity as the weight of debt increases.

7.10.3.2 Development of cost of debt, cost of equity and weighted average cost of capital over time

The pre-tax cost of debt in 2018 is assumed to start from 8,41% and converging to 8,33% by the end of 2018 caused by small improvements in Tesla's credibility. The 8,41% pre-tax cost of debt is based on the assumption that the credit rating of Tesla will be downgraded to B3 in the beginning of 2018, implying a default spread of 6,00%. The main assumption for the cost of debt is that due to approaching positive operating profits and a general strong improvement of Tesla's financials over time, the default spread will

also steadily decrease. By building an interpolation model for Tesla based on Damodaran's interpolation model it implies an improvement in credit rating to AAA by 2027 which is based on an calculated interest coverage ratio of 21,0 in 2027. This results in a default spread of 0,75% which will be added to the risk-free rate of 2,405% to arrive at the pre-tax cost of debt of 3,155% in 2027. The cost of debt is converging to this target rate with a switch from pre-tax cost of debt in 2024 to after-tax cost of debt starting from 2025 due to a nullifying of NOL carried forward.

The cost of equity however increases due to an increasing level of financial leverage in the company, which increases the levered beta of Tesla and consequently the cost of equity as the risk-free rate and the market risk premium are kept stable over time. The beta of an investment describes the risk that the investment adds to a market portfolio (Damodaran, 2012) and therefore the company's risk relative to the market. This risk increases due to an increase in financial leverage as the company is more exposed to market risk. Higher leverage increases the variance in net income which results in more risk for equity investors. The only drop in the cost of equity is between 2024 and 2025 when the tax shield is included in the calculation of levered beta. An increasing cost of equity implies an increase in expected returns by shareholders due to an increase in risk for shareholders.

The annual weighted average cost of capital is then calculated by applying the formula presented in the theoretical part. As Tesla does not show any preferred stock, the weight and cost of preferred stock equals zero. It is visible that each year the WACC is declining, implying decreasing costs f financing for the company. The main implication is that investments into the company are connected to declining overall risk over time. This explicitly refers to declining overall risk, as the cost of equity on the other side is increasing, as described above whereas the cost of debt decreases.

The annual WACCs, reflecting the risk in the company, are used as the discount factors of the underlying annual cash flows to arrive at the firm value for Tesla.

7.11 Terminal year

For the terminal year the following assumptions are made:

- Tesla's first five years of forecast are shaped by a high growth phase and it is assumed that the company will reach stable growth after ten years.
- The perpetuity growth rate equals the risk-free rate both in nominal terms as the whole valuation is prosecuted in nominal terms. In the long run the nominal risk-free rate will converge to the nominal growth rate in the economy.

- The company is not able to create excess returns in perpetuity, meaning the return on invested capital equals the cost of capital in perpetuity → increasing the perpetuity growth rate will have no effect on value → ROIC = WACC = 6,65% in Terminal Year
- The D/(D+E) ratio remains the same in stable growth
- Assumption that Tesla is able to remain a going concern with probability of 80% and that the company will not survive with probability of 20% → will be reflected in the calculation of Tesla's firm value

The reinvestment rate in stable growth is calculated according to the formula presented in the theoretical part, which also ensures internal consistency of the underlying growth and reinvestment assumptions.

Reinvestment Rate in stable Growth = $\frac{\text{Stable Growth Rate}}{\text{ROC}_n}$

This leads to the following calculations:

Table 64: Free cash flow to the firm of Tesla in terminal year

Reinvestment & FCFF (TY)	**Terminal Year ($, in millions)**
Stable growth rate	2,41%
/ ROC (stable growth)	6,65%
= **Reinvestment rate**	**36,2%**
* (EBIT (1-t))	12.950
= Reinvestment Amount	**4.683**
EBIT (1-t)	12.950
– Reinvestment Amount	4.683
= FCFF (TY)	**8.267**

After the FCFF (TY) was calculated, it is possible to receive the terminal value by dividing the FCFF (TY) by the difference between the cost of capital in stable state and the stable growth rate.

Table 65: Terminal value calculation

Terminal Value	**$, in millions**
FCFF (TY)	8.267
/ (WACC stable growth – stable growth rate)	/ (6,65% - 2,41%)
= Terminal Value	**194.732**

The result shows that the terminal value of Tesla accounts for $194.732 million before discounting back to present value.

7.12 Firm value, equity value & implied share value

After the underlying assumptions and calculations for the terminal year are made, it is possible to compute the firm value and equity value of Tesla including the implied share price, which will then be interpreted.

7.12.1 Calculations

Table 66 summarizes the most important calculations and assumptions which serve as the basis for the calculation of the firm value. This table also aims to illustrate the connection between the single calculations and assumptions made throughout the thesis. The firm value is retrieved by discounting back the future expected cash flows by its annual cumulated cost of capital.

Table 66: Free cash flow to the firm model of Tesla (I)

$, in millions	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	TY
Revenues	**23.289**	**31.617**	**39.676**	**49.826**	**63.156**	**78.759**	**95.959**	**110.300**	**117.395**	**120.221**	**123.113**
Revenue growth	98,1%	35,8%	25,5%	25,6%	26,8%	24,7%	21,8%	14,9%	6,4%	2,41%	2,41%
Operating income	**-1.210**	**-992**	**-429**	**486**	**1.915**	**4.008**	**6.857**	**10.150**	**13.217**	**16.008**	**16.393**
Operating margin	-5,2%	-3,1%	-1,1%	1,0%	3,0%	5,1%	7,1%	9,2%	11,3%	13,3%	13,3%
- Tax Rate	21%	21%	21%	21%	21%	21%	21%	21%	21%	21%	21%
EBIT (1-t)	**-1.210**	**-992**	**-429**	**486**	**1.915**	**4.008**	**6.857**	**8.238**	**10.442**	**12.646**	12.950
– Reinvestment	10.911	7.111	6.269	7.249	8.801	9.579	9.865	7.719	3.597	1.355	4.683
FCFF	**-12.121**	**-8.103**	**-6.698**	**-6.763**	**-6.886**	**-5.571**	**-3.009**	**519**	**6.844**	**11.292**	8.267
NOL	12.890	13.882	14.311	13.825	11.910	7.902	1.045	0	0	0	0
Cost of Capital	9,08%	8,10%	8,10%	8,06%	8,01%	7,92%	7,80%	7,01%	6,84%	6,65%	6,65%
Cum.. Disc. factor	0,92	0,85	0,78	0,73	0,67	0,62	0,58	0,54	0,51	0,47	0,47
PV (FCFF)	**-11.112**	**-6.872**	**-5.255**	**-4.910**	**-4.629**	**-3.470**	**-1.738**	**280**	**3.459**	**5.351**	**92.276**

Implied variables	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	TY
Sales / Capital	1,06	1,17	1,29	1,40	1,51	1,63	1,74	1,86	1,97	2,09	
Invested Capital	25.109	32.220	38.489	45.738	54.540	64.119	73.984	81.703	85.300	86.655	
ROIC	-4,82%	-3,08%	-1,11%	1,06%	3,51%	6,25%	9,27%	10,08%	12,24%	14,59%	6,65%

After calculating the PV of annual FCFF, the results are cumulated. An interesting fact is that the terminal value accounts for more than 100% of Tesla's total value, which is extremely high even for growth companies and implies strong future expectations and high growth assets. The assumed probability of failure of 20% is included in the computation of the firm value, by incorporating the underlying assumptions into the calculation.

Table 67: Free cash flow to the firm model of Tesla (II)

Firm value	$, in millions
PV (CF over next ten years)	-28.897
+ PV (CF in TY)	92.276
= Sum of PVs	**63.379**
* Distress Proceeds as percentage	50%
= Proceeds if firm fails	**31.689**
Probability of Failure	20%
= Firm Value	**57.041**

By adding up the present values of future cash flows and the PV of cash flow in terminal year, the sum of present values is retrieved. To adjust for the probability of failure, it is assumed that in case of liquidation the company is able to sell its assets for 50% of its market value. A rate of 50% is assumed that in case of liquidation a company usually never gets 100% and it is assumed that for Tesla there are potential buyers of its assets and that there is some hurry for liquidation. Therefore a percentage of 50% seems reasonable, which allows calculating the proceeds in case of company failure.

The value of operating assets is retrieved by multiplying the proceeds if firm fails by the probability of failure and the probability of going concern in perpetuity (1 – probability of failure) by the sum of PVs for the assumption of Tesla being a going concern in perpetuity.

These calculations result in a firm value of $57.041 million. To derive the equity value of the company several adjustments need to be done which are shown in table 68.

Table 68: Equity value of Tesla

Equity Value	**$, in millions**
Firm Value	**57.041**
– Debt	11.310
– Minority Interests	0
+ Cash and Cash Equivalents	3.368
+ Non-operating assets	0
= Value of Equity	**49.098**

The value of equity does not include any debt or minority interests, therefore both have to be subtracted from the firm value. Minority interests are non-existing and the total debt amount represents the value after all adjustments, which was calculated in chapter 7.4.3 Treatment of operating leases. On the other side, cash and cash equivalents and non-operating assets have to be added back to arrive at the equity value of $49.535 million, which will be divided by the previously calculated fully diluted shares outstanding to arrive at the implied share price for Tesla. For the calculation actual numbers of equity value and fully diluted shares outstanding are used to arrive at the correct share price.

Table 69: Implied share value Tesla

Implied Share Value	**Amount**
Equity Value	$ 49.098.217.188
Fully Diluted Shares Outstanding	179.013.348
Estimated value as of 31st of December 2017	**$ 274,27**
Share Price as of 31st of December 2017	$ 311,64
Implied Share Price as % of Value	**113,62%**

The estimated share value for Tesla as of 31st of December 2017 is $274,27 which is below the traded price of Tesla as of 31st of December of $311,64 and reflects the estimated intrinsic value of the company.

7.12.2 Interpretation of results

After the firm value, equity value and the implied value per share are calculated the results are interpreted. With the official share price as of 31st of December 2017 trading at $311,64 the stock seems slightly overvalued, given the assumptions made in the valuation model. The following table compares the calculated equity value of Tesla to the equity value of a group of its closest competitors in 2017.

Table 70: Equity value of peer companies in comparison to Tesla

Company	Equity Value ($, in millions, as of 31st of December 2017)	Relative	Revenues ($, in millions)
Tesla (Actual)	57.961	-15%	11.759 (2017)
Tesla (Calculated)	49.098	-	120.221 (2027)
BMW	68.645	-28%	111.479
AUDI	37.528	+31%	67.928
Renault	29.307	+68%	66.394
Geely	31.118	+58%	13.742

The calculated equity value of Tesla is 15% lower than its actual price as of 31st of December 2017. On the other side the implied equity value is still significantly higher than these of AUDI, Renault and Geely but 28% lower in comparison to the equity value of BMW which equals a difference of almost $20 billion. This is an interesting fact as the valuation assumes that by 2026 Tesla will exceed the 2017 revenues of BMW. On the others side the comparison does not take into account future growth of BMW, which is already incorporated in its equity value. It is also visible that even though Geely showed higher revenues in 2017 compared to Tesla, Tesla's calculated equity value is almost $20 billion higher, which illustrates the future expectations that are connected to Tesla. The results also show that even though Tesla is expected to sell only half of the cars of BMW or AUDI it can compete with these companies and even outperform AUDI in terms of market capitalization. It reflects the strong competitive advantages Tesla possesses in comparison to its competitors due and a superior business model which make it so valuable.

However, the implied share price in the specific valuation model is just a reflection of the assumptions, which are considered to be the most probable ones made in this specific case.

In reality, however, these assumptions can differ significantly which results in deviations in the share value. The DCF output therefore is "viewed in terms of a valuation range based on a series of key input assumptions, rather than as a single value" (Rosenbaum & Pearl, 2013, p. 155). Therefore a sensitivity

analysis is conducted for the key value drivers and inputs that are most sensitive to the output value which is of high importance to provide a reasonable and adequate answer to the research question.

7.13 Sensitivity analysis

Some of the main value drivers in a DCF valuation are illustrated below:

- Revenue growth
- Operating Income Margin
- D/(D+E) ratio
- WACC
- Perpetuity Growth Rate

7.13.1 Conduction sensitivity analysis Tesla

In the case of Tesla a sensitivity analysis of the share price based on WACC and perpetuity growth rate is not assumed to yield interpretable results, as the WACC differs over the years and it is assumed that in perpetuity the WACC equals the ROIC, implying that additional growth will not result in additional value due to the absence of excess returns. Nevertheless, a sensitivity analysis was conducted for these inputs, which confirmed the assumption described above and is therefore not listed below.

Inputs that also yield more space for interpretability and better understanding of possible and reasonable share prices for Tesla are the target operating profit margin and the target D/(D+E) ratio as the weight of debt and equity also directly influences the WACC.

The sensitivity analysis is conducted below. Furthermore the sensitivity analysis describes the falsely use of book value weights for the computation of the target D/(D+E) ratio and its theoretical impact on the implied share price of Tesla by showing target D/(D+E) ratios based on both, market and book values.

Table 71: Sensitivity analysis Tesla

		Target Operating Margin				
	Share Value (in $)	**9,9% (Auto)**	**12,3%**	**13,3% (Target)**	**14,3%**	**15,5% (Max.)**
Target D/(D+E)	**16% (Current MV)**	113,30	223,43	269,40	315,34	368,77
	30%	115,44	225,74	271,79	317,80	372,29
	40% (Applied Median MV)	117,65	228,15	**274,27**	320,36	374,96
	45% (Median BV)	118,87	229,48	275,66	321,80	376,45
	50%	119,92	230,64	276,85	323,04	377,74
	64% (Current BV)	123,26	234,31	280,67	326,99	381,86
	90% (Target MV Interpolation)	129,80	241,58	288,25	334,88	390,11

7.13.2 Interpretation of results

The sensitivity analysis shows a range of possible outcomes for Tesla's implied share value. The most important conclusions are listed below:

- The implied share value is relatively insensitive to changes in the D/(D+E) Ratio. Even by changing the target ratio from 16% which equals the current D/(D+E) ratio of Tesla in market values to the target ratio of 40%, which was used in this work, the share value will only increase by less than 4% from $113,30 to $117,65 even though the ratio increased by 24%.
- It can also be concluded that the higher the D/(D+E) ratio, the higher the implied share value of Tesla, if leaving operating margin same. This corresponds to assumptions made by Modigliani and Miller saying that a mature company, which pays corporate taxes, should be totally debt financed as debt provides valuable tax shields.
- By only changing the target D/(D+E) ratio derived from market averages or medians (40%) to the ratio derived from interpolation (90%), the implied share value increases from $274,27 to $288,25. However, it is to mentioned that a target D/(D+E) of 90% in 2027 does not seem reasonable for Tesla, which was already described before in this thesis.
- To sum it up, the choice of an appropriate D/(D+E) ratio influences the implied share value. However, only if target ratios applied differ significantly the share price will also start showing slight differences in its value. This is due to the fact that the share value is considered to be rather insensitive to small and medium changes in the target D/(D+E) ratio and only shows bigger differences in case the target D/(D+E) ratio changes heavily.
- The target operating profit margin applied on Tesla, however, has significant influence on its implied share value. Therefore the implied share value is highly sensitive to changes in the target operating profit margin.
- This is clearly illustrated on the example by only changing the target operating profit margin from 13,3%, which was used in the main scenario of this thesis, to 12,3% and therefore only lowering the ratio by 1%. This might be due to changes in the assumption considering Tesla more of an automotive company rather than a tech stock, which could imply this decrease in operating margin. Only by slightly changing the weights in this assumption will result in a share value decrease of around 20%, from $274,27 (13,3%) to $228,15 (12,3%).
- On the other side by increasing the operating profit margin to 14,3% which might be due to a change in assumptions of the weights of the single sectors for example to this weight distribution: automotive 65%, Internet Media 22%, Energy Storage 8%, Energy Generation 5%, which also seems reasonable given past assumptions and interpretations regarding business model and sectors of operations, the implied share value increases to $320,36, which

is even above the share price of Tesla as of 31st of December 2017 of $311,64. This gives also the answer to the research question stating that the share price of Tesla as of 31st of December 2017 is reasonable.

- By only slightly changing the assumptions in the composition of weights of the operating profit margin, this share price can be achieved and even exceeded. The changes done to the operating profit margin are still reasonable allowing the conclusion that the implied share values are reasonable and therefore also Tesla's share price as of 31st of December 2017 of $311,64 as this price lies within the range of reasonable values computed for Tesla.
- An interesting conclusion is that by changing the assumption of Tesla being a high-tech, vertically integrated electric-vehicle manufacturer who also provides in-house energy generation and storage systems into Tesla solely being an automotive company with consecutive implications on its operating profit margin the implied share value of Tesla will significantly decrease. By only using the 80%-quantile of operating profit margins of peer companies in the automotive sector as Tesla's target operating profit margin and keeping the target D/(D+E) the same to the assumptions made in the thesis, the implied share value decreases drastically by 57% from $274,27 (13,3%) to 117,65 (9,9%). This explanation also puts light on the wide range of possible implied share values for Tesla computed by different investment banks and boutiques. The wide range of values is mainly attributable to the implied assumption about Tesla's business model and the ways of how Tesla generates its revenues and from which sectors it derives its margins. In case of Tesla is assumed to be rather a high-tech, vertically integrated, upper-segment electric vehicle manufacturer, like in this thesis, rather than solely a car manufacturer will have significant impact on the value of the company.
- Therefore the potential downside of Tesla's share price also depends on the assumptions made about the company. If it is valued as a pure automotive company, keeping the target D/(D+E) ratio at 40%, the downside potential would equal 62% (downside in comparison to the share price as of 31st of December 2017) and in case it is assumed that Tesla will keep its current market D/(D+E) ratio the downside potential even slightly increases to 64% as the implied share value decreases to $113,30.
- On the other side, the potential upside of Tesla depends on the maximum reasonable operating profit margin assumed to be achieved by the company. As it was already argued before a target operating profit margin of 14,3% still seems reasonable for Tesla. The highest reasonable assumption about Tesla's target operating profit margin is set at 15,5% which can be for example achieved by Tesla being assumed to be a 60% car manufacturer, 30% High-tech, 5% Energy Storage and 5% Energy Production company, which results in the maximum

operating profit margin of 15,5%. Based on this assumption the possible upside of the stock is 20% with a target share value of $374,96. This confirms one more time the answer to the research question implying that the share price of Tesla as of 31st of December is reasonable.

- After computing both, the possible upside and the possible downside of the share, it shows that the possible downside is significantly higher than the possible upside, given a target D/(D+E) ratio stable at 40%. The possible downside in this case is 62% whereas the possible upside only accounts for 20%. Therefore the so-called chance-risk-relationship of Tesla, which is often used for investment decisions, only lies by 0,32 (upside/downside) which is rather low. Florian Homm, former German hedgefund manager, recommends a chance-risk relationship of at least 2:1, or even 3:1. Consequently, out of an investment point of view related to the chance-risk-relationship, an investment in Tesla seems currently rather risky with low expected upside and high expected downside.
- The sensitivity analysis also gives an answer to hypothesis 1 of this thesis. The hypothesis states that the share price is priced to perfection, implying no upside potential. However, the sensitivity analysis proves a reasonable upside potential of 20% resulting in a maximum share value of $374,96. Therefore hypothesis 1 can be rejected, even though the stock shows more downside potential than upside potential.

All the conclusions made through the sensitivity analysis and the calculation of the implied share value allow drawing a precise picture of Tesla's current situation, its expected performance in the future and a precise analysis of Tesla's traded share price as of 31st of December with possible implications for future possible and reasonable developments in the stock market.

8 Elon Musk – personal brand value

Elon Musk, CEO of Tesla, is undoubtedly the personalized face of the company. His amount of admirers and supporters is at least as numerous as his critics. For many people, investing in Tesla or buying a Tesla product is equated with investing or believing in the developments and success of Musk. Therefore Elon Musk carries a strong personal brand value with him and it is also assumed that he strongly contributes to the success of Tesla in many ways. Therefore the following chapter describes the different contributions of Musk towards Tesla and tries to estimate his personal brand value by applying an opportunity cost approach.

8.1 Contributions to Tesla

Musk is known as one of the most innovative heads of our time. Within Tesla he currently holds the positions of CEO, chairman of the board of directors and product architect. By holding three of the most important positions within the company, Musk is considered having a strong influence and impact on both operational and financial issues.

Additionally, Musk is also the biggest shareholder of the company holding more shares than any other private or corporate investor, providing a significant portion of Tesla's equity. The table below summarizes some of the biggest shareholders in Tesla and its amount of shares held.

Table 72: Tesla share distribution

Shareholder	Amount of shares held in the company as of 31st of December 2017
Musk, Elon Reeve	**33.632.421**
FMR LLC	16.819.987
T. ROWE PRICE Group	10.796.895
Baillie Gifford	12.902.408
Tencent Holdings	8.347.094

Besides his strong contribution in operational and financial issues Musk is also considered contributing in terms of advertisement and brand recognition. His strong support and vast impact is also illustrated by his broad base of followers on Twitter and Instagram, where he currently has 6.9 million followers, which is more than Tesla (4,1 million) or any other CEO of a car manufacturing company. This is also considered to be an additional, cost-free source of advertisement for him and his products with a wide range based on his strong follower base. By the use of modern media channels by its CEO, Tesla further the image of being a high-tech, up-to-date, trendy company.

In 2018 Musk agreed on a new ten-year compensation plan, the so called "2018 CEO Performance Award". However, it is not necessary for Musk to stay CEO of Tesla throughout the length of the contract, but the only other roles he is allowed to take comprise executive chairman or chief product officer.

The award is a combination of different milestones, market capitalization and operational milestones, which have to be achieved together. For each milestone achieved by Tesla, Musk is granted 1% of the total shares outstanding as of 21st of January 2018, which equals approximately 1,7 million shares. The contract comprises the following market capitalization:

Table 73: Market capitalization milestones

Market Cap. Milestones												
Milestones	$100B	$150B	$200B	$250B	$300B	$350B	$400B	$450B	$500B	$550B	$600B	$650B

And operational milestones:

Table 74: Operational milestones

Operational Milestones								
Revenue	$20B	$35B	$55B	$75B	$100B	$125B	$150B	$175B
Adjusted EBITDA	$1,5B	$3B	$4,5B	$6B	$8B	$10B	$12B	$14B

It is assumed that if all options fully vest, "Musk could wind up owning a 28 percent stake of Tesla, which could be worth nearly $200 billion" (O'Kane, 2018).

By this compensation plan it is assumed that Musk will also have a strong impact on Tesla in future years in terms of both operational and financial development of the company. In case of reaching his claimed goals Musk can become one of the most influential and richest people in the world.

After conducting a first analysis of the level of contribution and influence Musk has on the financial and operational performance of Tesla, it is also a first hint that confirms the hypothesis that Elon Musk has significant influence on the value of Tesla.

8.2 Personal brand value Elon Musk – opportunity cost approach

After confirming that Musk has strong influence on the performance and therefore value of the company, one approach of estimating the personal brand value of Elon Musk is to calculate the opportunity costs of another company for not hiring Elon Musk. The company of comparison is BMW, one of Tesla's closest competitors in the automotive segment. To estimate the brand value of Elon Musk free cash flows to equity will be estimated firstly without Musk being involved in the company and then with a premium applied on car sales if Musk was head of BMW. The difference of these future cash flows will represent the opportunity costs for BMW and therefore the personal brand value of Musk. Furthermore it is assumed

that hiring Elon Musk will only affect sales numbers as the main effect of hiring Musk will relate to marketing effects which will increase sales numbers and with effectivity and profitability not affected by this step.

8.2.1 Value of BMW without Elon Musk

Firstly, car sales will be forecasted without having Elon Musk in the company based on historical average growth rates from 2015 – 2017. The FCFE will be forecasted for 2018 based on the average growth rate between 2015 and 2017 and afterwards the growth rate will be adjusted to the risk-free rate used in discounting for BMW, which equals the bond yield of the German government bond. Additionally, the FCFE per car will be calculated by dividing the FCFEs by the underlying amount of cars sold.

Table 75: BMW – Annual free cash flow to equity without Elon Musk

$, in millions	2017	2018	2019	Terminal Year
Cars sold in millions	2,09	2,19	2,30	2,41
Average Growth (’15 – ’17)	4,9%	4,9% (yoy)	4,9% (yoy)	4,9% (yoy)
FCFE	3.033	3.663	3.682	3.701
Average Growth (’15 – ’17)	20,8%	20,8% (yoy)	0,5% (yoy)	0,5% (yoy)
FCFE per car	1.453	1.673	1.604	1.538
Average Growth (’15 – ’17)	15,2%	15,2% (yoy)	-4,1% (yoy)	-4,1% (yoy)

The cash flows will then be discounted back to receive the NPVs which are added up to receive the equity value of BMW without Elon Musk.

Table 76: BMW – Equity value without Elon Musk

$, in millions	2018	2019	Terminal Year
FCFE	3.663	3.682	3.701
NPV	3.392	3.157	39.665
WACC	8,0%		
Equity Value	**46.214**		

The total equity value of BMW without Elon Musk equals $46,2 billion.

8.2.2 Value of BMW with Elon Musk

After calculating the value of BMW without Elon Musk, now Elon Musk is considered to become part of BMW. The main assumption is that due to strong publicity effects from Musk’s change to BMW and the high amount of personal supporters, which are then assumed to follow Musk to BMW by substituting Tesla cars with BMW cars, the amount of cars sold per year will significantly increase.

The assumption is that BMW will be able to increase its amount of cars sold by additional ten percent, which is the premium of Elon Musk. This number equals additional car sales of approximately 200.000

units in the first year, which is around twice the amount of cars Tesla sold in 2017 and a little less than the amount of cars expected to be sold by Tesla in 2018 with increased production of Model 3. The underlying calculations are illustrated in table 77.

Table 77: BMW – Annual free cash flow to equity wit Elon Musk

$, in millions	2017	2018	2019	Terminal Year
Cars sold in millions	2,09	2,40	2,75	3,16
Average Growth (’15 – ’17)	4,9%	14,9% (yoy)	14,9% (yoy)	14,9% (yoy)
FCFE	3.033	4.012	4.418	4.864
Average Growth (’15 – ’17)	20,8%	32,3% (yoy)	10,1% (yoy)	10,1% (yoy)
FCFE per car	1.453	1.673	1.604	1.538
Average Growth (’15 – ’17)	15,2%	15,2% (yoy)	-4,1% (yoy)	-4,1% (yoy)

The FCFE per car was kept the same and with the amount of cars sold it is possible to calculate the FCFE generated by BMW with Elon Musk and an assumed sales unit premium of 10%.

Table 78: BMW – Equity value with Elon Musk

$, in millions	2018	2019	Terminal Year
FCFE	4.012	4.418	4.864
NPV	3.715	3.788	52.131
WACC	8,0%		
Equity Value	**59.634**		
Additional Cars sold	208.828	458.797	756.508

The brand value of Elon Musk then equals the opportunity costs of BMW, which is the difference between both equity values.

Table 79: Personal brand value Elon Musk

Personal Brand Value Elon Musk	$, in millions
Equity Value with Elon Musk	59.634
- Equity Value without Elon Musk	46.214
= Personal Brand Value Elon Musk	**13.420**

By applying an opportunity cost approach for computing the personal brand value of Elon Musk on the example of BMW, a personal value of $13,4 billion can be assigned to Elon Musk. This is the amount BMW needed to pay in order to hire Elon Musk, which is the difference between the assumed equity value of BMW without Elon Musk and the assumed equity value with Elon Musk.

Moreover it is assumed that Musk with his strong personal brand value has at least the same amount of influence on the value of Tesla, which confirms hypothesis 3 that Elon Musk significantly influences the value of Tesla. After conducting the analysis it is possible to say that Musk significantly increases the

value of the company. This hypothesis is assured by the new compensation plan Musk which the shareholders agreed on, which can bring up to $200 million to Musk in case all milestones are achieved.

9 Conclusion

Tesla is considered to be one of the most controversially discussed companies and stocks in the world. This thesis aims to explain the reasonability of Tesla's share price as of 31st of December 2017 and to provide a framework for valuing a growth company like Tesla, a company with financial and operating risks, going concern issues but on the other side a company with high growth potential. Besides the research question, three hypotheses are postulated which the thesis aims to answer. The three hypotheses are:

- Hypothesis 1: Tesla's share price as of 31st of December is priced to perfection.
- Hypothesis 2: Tesla's business model is superior to those of its closest competitors.
- Hypothesis 3: Elon Musk has significant influence on the value of Tesla.

An overall framework was provided to retrieve Tesla's intrinsic value and provide reasonable and plausible answers to the thesis' research question and to the underlying hypotheses.

Firstly, a theoretical fundament was set by summarizing main information and valuation techniques for growth companies in the economy. Main sources were retrieved from Aswath Damodaran, who is considered one of the most reliable valuation experts, and adopted to the framework of the valuation of Tesla. Problems considered to be faced in the practical approach of the valuation were elaborated and theoretical solutions were provided to be applied in the process of valuation. The theoretical approach is considered to provide sufficient background for a successful analysis of the topic.

The thesis continues by analyzing Tesla's business model, the fundament of the company's competitive advantages. The basis of this analysis forms the research paper "Business Model Warfare" by Langdon Morris. It can be concluded that Tesla's business model is superior to those of its closest competitors, accepting hypothesis 1, due to Tesla's high innovation strength in the fields of administration, customer experience and customer service and its strong competitive advantages, which are assumed to sustain over time. Concluding the in-depth analysis of Tesla's business model, the company is evaluated as a fully vertically integrated high-tech company, with main operations in the pure battery electric vehicle market in combination with growing presence in the segments of energy generation and storage, as which company it will be valued.

The present car market is in a period of strong disruptions and changes. Past car market sales numbers in the total passenger car market, total electric vehicle market and the battery electric vehicle market were analyzed in order to evaluate those trends on the sales numbers in the markets, which are assumed to allow first implications of future developments. Moreover, information about single countries' policies and stimulations of the electric vehicle market are gathered as they are assumed to directly affect future sales

numbers in the market, too. Table 1 in the appendix provides a detailed overview of these country targets and puts it into an own prediction framework by contrasting forecasts conducted by well-known investment banks with own predictions of sale numbers in the electric vehicle market. The main results comprise a strong growing electric vehicle market which is also expected to grow heavily throughout the next ten years, with the technology of choice being the pure battery electric vehicles rather than plug-in hybrids. Main players are considered to be China with more than 60% of total sales in 2021 and Europe which will account for the highest portion of electric vehicles sales in the market by 2027, overtaking China. The strong growth in the market also implies an intensified substitution of combustion engines by electric vehicles. The forecast also aims to ensure plausibility of Tesla's estimated future vehicle sales, as Tesla's future sales margins are compared to those of its closest competitors in the market.

By analyzing past and present sales numbers by companies instead of countries in the relevant markets, Tesla's closest competitors in its main market of operation are derived. Table 2 in the appendix provides a detailed overview of selected companies, its present and future incentives in the electric vehicle market and a competitive analysis in relation to Tesla's current and estimated future targets to derive Tesla's future competitive position in the market. Main findings are: Established car manufacturers focus on a strong expansion of electric vehicle sales until 2025 and government funded start-ups, mainly from China, further intensify the competition in the market. A comparison of future car introductions of competitors to Tesla's vehicle in place during that time allows in-depth and reasonable assumptions about annual growth potential of Tesla's single models. It is assumed that Tesla withstands most of its competition, mainly due to strong competitive advantages, which, however, might decrease over time.

Financial statements of Tesla, mostly comprising income statement, balance sheet and cash flow statement, are then adjusted for operating lease and R&D expenses in conjunction with retrieving Tesla's fully diluted shares outstanding by applying the treasury stock method and if-converted method for specific options and convertible bonds respectively, which forms the basis of financial interpretability of Tesla's financial statements.

The practical part of this thesis continues by estimating sales numbers and revenues of each vehicle model, given the framework provided in this thesis. Business model analysis, competitive advantages and market estimations provide the fundament for reasonable assumptions. Moreover, energy generation and storage revenues are estimated based on past growth figures and market and competition research provided, with the revenue forecast showing a high growth phase of Tesla for the upcoming five years and declining growth rates the next five years, with reasons for the decline given in the thesis.

The target operating profit margin of Tesla is retrieved by calculating averages, medians and quantiles of competitors' profit margins in the underlying sectors. Due to strong competitive advantage in the

segments of automotive and energy storage, higher quantiles are assumed to be reached with weights of the single influence of the sectors based on generated revenues in present and future. It is assumed that Tesla is capable of reaching a total target operating profit margin of 13,3%, which is under the best margins in the automotive segment, which can be explained by Tesla's superior business model (vertical integration) and competitive advantages.

Free cash flows to the firm are received by subtracting reinvestment needs from Tesla's NOPLAT. The computation of annual reinvestment needs is based on the sales-to-capital ratio which builds up on similar assumptions and weights than the operating profit margin, also to ensure consistency throughout the valuation process. An interesting finding is that Tesla's free cash flows are estimated to be negative until 2025, when they turn positive for the first time. Moreover the terminal value accounts for more than 100% of the total value as the sum of the present values of Tesla's first ten year free cash flows is negative. By including a probability of failure, contributions are made to Tesla's currently difficult financial situation, which was described into details during the practical part. The assessment shows a probability of failure and not going concern assumption of 20%.

These assumptions lead to an implied firm value of $57 billion and by subtracting net debt an implied equity value for Tesla of $49 billion is retrieved which equals an implied share value of $274,27. A first interpretation allows saying that, given the assumptions made in the valuation approach, Tesla's share price seems slightly overvalued. However, to conduct further interpretations and illustrate the sensitivity of the implied share value on different assumptions and inputs, a sensitivity analysis is applied. Inputs that are tested against changes in the share value are target D/(D+E) ratio and target operating profit margin. The results show that changes in the target D/(D+E) only have small influence on the development of the underlying share value. However, it also implies that by selecting the wrong target D/(D+E) ratio, wrong implications can be drawn. On the other side, the implied share value proves to be highly sensitive to changes in the target operating profit margin. A change of 1% in the margin increases or decreases the value by approximately 16%, given all other inputs constant. The sensitivity analysis also illustrates that the classification of Tesla's business model is of very high importance. By valuing Tesla as a pure player in the electric vehicle market, the implied share value drops to $117,65, a decrease of 133%. This might also demystify why many investment banks provide a wide range of different target values for Tesla. The sensitivity analysis provides a range of reasonable results of Tesla's implied share value, with its share price as of 31st of December lying in this range. Therefore the research question if Tesla's share price as of 31st of December 2017 is reasonable, can be answered by saying that Tesla's share price as of 31st of December 2017 is reasonable based on the assumptions made in this thesis. The last reasonable share value for Tesla is assumed to be $374,96. It shows that there is still some possible upside in the

development of Tesla's share price, which allows rejecting hypothesis 1 that Tesla's share price is priced to perfection.

Additionally, an approach was applied to estimate the personal brand value of Elon Musk and his influence on the value of Tesla. By arguing that Tesla's shareholders agreed to a new, in case of success well-awarded compensation plan in the beginning of 2018, the influence of Elon Musk on Tesla has to be immense, as his compensation is linked to market capitalization and operational milestones. In order to amplify this assumption an opportunity cost approach on the example of BMW, one of Tesla's closest competitors, was applied to retrieve approximations of Musk's personal brand value, which is assumed to equal to the difference between the equity value of BMW without hiring Musk and BMW's equity value in case of hiring Musk. Furthermore it is assumed that this action will mostly influence sales due to high publicity of this act. The total difference between the equity values is calculated to be more than $13 billion, which is assumed to equal Elon Musk's personal brand value. Furthermore an assumption made is that the influence on Tesla has to be at least as strong as on BMW due to Musk's strong connection to the company. Therefore it can be concluded that Elon Musk has significant influence on the value of Tesla, accepting hypothesis 3.

The thesis adds value to the literature and valuation models already available, by putting high reasonability behind each single assumption, based on extensive research in the fields of business model, competitors, market trends and estimations which ensures plausible and reasonable outputs.

The thesis gives reasons for highly differing implied share values provided by analysts and equity researchers and tries to demystify the difficulties linked to valuations of young, distressed and complex businesses (Damodaran, 2010) such as Tesla by providing a valuation framework to follow.

Bibliography

Ausick, Paul. “13 Cars That Compete With the Tesla Model 3.” *247wallst.Com*, 31 July 2017, 247wallst.com/autos/2017/07/30/13-cars-that-compete-with-the-tesla-model-3/.

Ayre, James. “Baojun E100 EV Availability Continuing To Expand, Price Now Only ~$7,300 -- Why Doesn't GM Offer Something Similar In US?” *CleanTechnica*, 13 Feb. 2018, cleantechnica.com/2018/02/13/baojun-e100-ev-availability-continuing-expand-price-now-7300-doesnt-gm-offer-something-similar-us/.

Bary, Andrew. “Will Traditional Auto Makers Steal the Future From Tesla?” *Barron's*, Barrons, 11 Nov. 2017 (I), www.barrons.com/articles/will-traditional-auto-makers-steal-the-future-from-tesla-1510374577.

Bary, Emily. “Watch Out, Tesla. The Competition Is Gaining.” *Barron's*, Barrons, 30 Sept. 2017 (II), www.barrons.com/articles/watch-out-tesla-the-competition-is-gaining-1506746035.

Blackrock Investment Institute. “Future of the vehicle. Winners and losers: from cars and cameras to chips.” *Blackrock Investment Institute*, Blackrock, April 2017, https://www.blackrock.com/corporate/literature/whitepaper/bii-future-of-vehicle-2017-international.pdf.

Capitalist, Visual. “Tesla Is the World's 4th Largest Automaker by Value.” *Business Insider*, Business Insider, 21 Aug. 2017, www.businessinsider.com/tesla-stock-price-worlds-4th-largest-automaker-by-value-2017-8.

Chambers, Madeline, and Georgina Prodhan. “Daimler in $2 Billion China Investment with BAIC as Geely Swoops.” *Reuters*, Thomson Reuters, 25 Feb. 2018, www.reuters.com/article/us-daimer-geely-stake-berlin/daimler-in-2-billion-china-investment-with-baic-as-geely-swoops-idUSKCN1G90FS.

Chierotti, Logan. “Tesla Has a New Competitor in the World's Biggest Electric Car Market.” *Inc.com*, Inc., 22 Dec. 2017, www.inc.com/logan-chierotti/tesla-has-a-new-competitor-in-worlds-biggest-electric-car-market.html.

Cornerstone Investments Long only. “Tesla's Path To $650 Billion.” *Seeking Alpha*, Seeking Alpha, 23 Feb. 2018, seekingalpha.com/article/4150057-teslas-path-650-billion.

Cox, Nick. “Tesla Energy Storage Business About To Take Off.” *Seeking Alpha*, Seeking Alpha, 30 Apr. 2018, seekingalpha.com/article/4167558-tesla-energy-storage-business-take?app=1&auth_param=1f2t5n%3A1deei2q%3Abefdbcb48f80123e26ab71544822112e&uprof=23&dr=1#alt1.

Cummings, Steve. “Plugless | Tesla or GM, Who Will Lose the $7500 Tax Credit First?” *Plugless Power*, 22 Feb. 2017, www.pluglesspower.com/learn/forecasting-the-sunset-of-federal-tax-credits-for-evs/.

Damodaran Aswath. “Dealing with Operating Leases in Valuation.” *Stern School of Business.* 2008 (I), http://people.stern.nyu.edu/adamodar/pdfiles/papers/oplev.pdf.

Damodaran Aswath, “Growth and Value: Past growth, predicted growth and fundamental growth.” *Damodaran*, Stern School of Business, June 2008 (II), http://people.stern.nyu.edu/adamodar/pdfiles/papers/growthorigins.pdf.

Damodaran Aswath. “Investment Valuation: Tools and Techniques for Determining the Value of Any Asset.” *John Wiley & Sons Inc.*, 2012, ISBN 978-1-118-01152-2.

Damodaran Aswath. “Leases, Debt and Value.” *Stern School of Business,* 2009, http://people.stern.nyu.edu/adamodar/pdfiles/papers/newlease.pdf.

Damodaran Awath. “Research and Development Expenses: Implications for Profitability Measurement and Valuation.” *Stern School of Business,* 2007 (I), http://pages.stern.nyu.edu/~adamodar/.

Damodaran Aswath. “Return on Capital (ROC), Return on Invested Capital (ROIC) and Return on Equity (ROE): Measurement and Implications.” *Stern School of Business,* 2007 (II), http://people.stern.nyu.edu/adamodar/pdfiles/papers/returnmeasures.pdf.

Damodaran Aswath. “The Dark Side of Valuation: Valuing Young, Distressed, And Complex Businesses.” *2nd Edition Pearson Education Inc.*, 2010, ISBN 0-13-443118-9.

Deloitte. “Truck Market 2024: Sustainable Growth in Global Markets.” *Deloitte,* 2014, https://www2.deloitte.com/content/dam/Deloitte/tr/Documents/process-and-operations/truck-studie-2014-s.pdf.

Dwilson, Stephanie Dube. “Tesla Model 3: Price, Options, & Specs.” *Heavy.com*, Heavy.com, 29 July 2017, heavy.com/news/2017/07/tesla-model-3-price-options-specs-cost-what/.

Eckhouse, Brian. “Tesla Loses Top Spot in Residential Solar to Sunrun.” *Bloomberg.com*, Bloomberg, 6 Mar. 2018, www.bloomberg.com/news/articles/2018-03-06/tesla-losing-top-spot-in-solar-to-sunrun-as-musk-shifts-gears?cmpid=socialflow-facebook-markets&utm_content=markets&utm_campaign=socialflow-organic&utm_source=facebook&utm_medium=social.

Edelstein, Stephen. “Byton and Aurora Team up on Self-Driving Cars.” *The Drive*, 7 Feb. 2018 (I), www.thedrive.com/news/18308/byton-will-get-self-driving-car-tech-from-aurora?iid=sr-link9.

Edelstein, Stephen. “China Will Subsidize Self-Driving Cars, VW Executive Says.” *The Drive*, 12 Mar. 2018 (II), www.thedrive.com/tech/19159/china-could-drive-demand-for-autonomous-cars-vw-exec-says?iid=sr-link9.

Edelstein, Stephen. “Chinese Electric-Car Startup Nio Plans U.S. Stock Offering, Report Says.” *The Drive*, 28 Feb. 2018 (III), www.thedrive.com/tech/18868/chinese-electric-car-startup-nio-reportedly-plots-u-s-stock-ipo?iid=sr-link3.

Edelstein, Stephen. “Electric Cars Continue To Get Cleaner, Study Says.” *The Drive*, 14 Mar. 2018 (IV), www.thedrive.com/news/19225/electric-cars-are-cleaner-than-ever-study-says?iid=sr-link3.

Edelstein, Stephen. “Global Electric-Car And Plug-In Hybrid Sales Surpassed 1 Million In 2017, Report Says.” *The Drive*, 4 Jan. 2018 (V), www.thedrive.com/tech/17368/global-electric-car-and-plug-in-hybrid-sales-surpassed-1-million-in-2017-report-says.

Edelstein, Stephen. “Volkswagen Plans 16 Production Sites For Electric Cars.” *The Drive*, 13 Mar. 2018 (VI), www.thedrive.com/news/19194/vw-expects-to-have-16-production-sites-for-electric-cars-by-2022?iid=sr-link5.

Engineering Energy Analysis. “The Scary Tesla Chart That Isn't So Scary.” *Seeking Alpha*, Seeking Alpha, 22 Feb. 2018, seekingalpha.com/article/4149436-scary-tesla-chart-scary.

Eule, Alex. “Actually, Eliminating the EV Credit Could Help Tesla.” *Barron's*, Barrons, 3 Nov. 2017, www.barrons.com/articles/actually-eliminating-the-ev-credit-could-help-tesla-1509737765.

EV-Volumes. “Global Sales for 2017.” *EV-Volumes - The Electric Vehicle World Sales Database*, 2018, www.ev-volumes.com/.

Foster Richard & Kaplan Sarah. “Creative Destruction: Why Companies That Are Built to Last Underperform the Market – and How to Successfully Transform Them.” *Crown Business*, Apr 2001, ISBN 978038550147.

Gibbs, Nick. “Tesla Model S Outsells German Luxury Flagships in Europe.” *Autonews.com*, 20 Feb. 2018, europe.autonews.com/article/20180220/ANE/180219831/tesla-model-s-outsells-german-luxury-flagships-in-europe.

Graham Benjamin. “The Intelligent Investor: The definitive book on value investing.” *HarperCollins Publishers Inc.,* 2003, ISBN 0-06-055566-1.

Hawkins, Andrew J. “How Tesla Changed the Auto Industry Forever.” *The Verge*, The Verge, 28 July 2017, www.theverge.com/2017/7/28/16059954/tesla-model-3-2017-auto-industry-influence-elon-musk.

Hertzke, Patrick, et al. “Dynamics in the Global Electric-Vehicle Market.” *McKinsey & Company*, July 2017, www.mckinsey.com/industries/automotive-and-assembly/our-insights/dynamics-in-the-global-electric-vehicle-market.

Hetzner, Christiaan. “Audi Starts Taking Deposits for e-Tron SUV.” *Autonews.com*, 29 Jan. 2018 (I), europe.autonews.com/article/20180129/ANE/180129814/audi-starts-taking-deposits-for-e-tron-suv.

Hetzner, Christiaan. “VW Vizzion Previews Potential Tesla Model S Rival.” *Autonews.com*, 19 Feb. 2018 (II), europe.autonews.com/article/20180219/ANE/180219744/vw-vizzion-previews-potential-tesla-model-s-rival.

Homm Florian & Dag Gublan. “Die Kunst des Leerverkaufes.“ *DIE ZWEITE MEINUNG Gmbh*, Florian Homm, 2017,ISBN 9781521247204.

Hughes, Justin. “Car Autonomy Levels Explained.” *The Drive*, 3 Nov. 2017, www.thedrive.com/sheetmetal/15724/what-are-these-levels-of-autonomy-anyway?iid=sr-link2.

Hull, Dana. “Tesla Unveils 'World's Fastest Production Car' and Electric Big Rig.” *Bloomberg.com*, Bloomberg, 17 Nov. 2017, www.bloomberg.com/news/articles/2017-11-17/tesla-unveils-electric-semi-truck-with-semi-autonomous-features.

Hull, Dana & Hannah Recht. “Tesla Doesn't Burn Fuel, It Burns Cash.” *Bloomberg.com*, Bloomberg, 30 Apr. 2018, www.bloomberg.com/graphics/2018-tesla-burns-cash/.

Kaas, Hans-Werner, et al. “Autom Otive Revolution – Perspective towards 2030.” *McKinsey & Company*, Jan. 2016, www.mckinsey.com/~/media/mckinsey/industries/high%20tech/our%20insights/disruptive%20trends%20that%20will%20transform%20the%20auto%20industry/auto%202030%20report%20jan%202016.ashx.

Koller Tim, Goedhart Marc & Wessels David. “Valuation: Measuring and Managing the Value of Companies.” *John Wiley & Sons, Inc.,* 2015, ISBN 978-1-118-87370-0.

Krisher, Tom. “GM's New Electric Car Could Upstage Tesla and Volt.” *Inc.com*, Inc., 12 Jan. 2015, www.inc.com/associated-press/gm-new-electric-car-bolt-could-upstage-tesla-and-volt.html?cid=search.

Lambert, Fred. “Elon Musk Is 'Optimistic' about Beating Tesla Semi Specs That Competitors Already Don't Believe Possible.” *Electrek*, 24 Feb. 2018 (I), electrek.co/2018/02/24/elon-musk-tesla-semi-specs-beat/.

Lambert, Fred. “Tesla Made over $2 Billion in China Last Year, Doubled Sales and Expanded Retail/Charging Presence.” *Electrek*, Electrek, 23 Feb. 2018 (II), electrek.co/2018/02/23/tesla-china-double-sales-expanded/.

Lambert, Fred. “Tesla Model 3: Top 10 Cars That Reservations Holders Are Replacing with the New EV.” *Electrek*, Electrek, 26 July 2017, electrek.co/2017/07/26/tesla-model-3-top-10-cars-being-replaced/.

Lambert, Fred. “Tesla Opens Another Giant 50-Stall Supercharger Station – Largest in the World.” *Electrek*, 26 Jan. 2018 (III), electrek.co/2018/01/26/tesla-largest-supercharger-station-world/.

Lambert, Fred. “Tesla to Deploy New Powerpack Battery Systems with NY's Largest Electric Utility.” *Electrek*, Electrek, 15 Feb. 2018 (IV), electrek.co/2018/02/15/tesla-deploy-powerpack-battery-ny-largest-electric-utility/.

Lambert, Fred. “Tesla's Giant Battery in Australia Made around $1 Million in Just a Few Days.” *Electrek*, 23 Jan. 2018 (V), electrek.co/2018/01/23/tesla-giant-battery-australia-1-million/.

Leary, Kyree. “EV Competition Heats up between Chinese Startup and Tesla.” *Futurism*, Futurism, 19 Dec. 2017, futurism.com/ev-competition-heats-between-chinese-startup-tesla/.

Levisohn, Ben. “Tesla: Why an EV Tax Credit Might Be Bad News.” *Barron's*, Barrons, 20 Dec. 2017, www.barrons.com/articles/tesla-why-an-ev-tax-credit-might-be-bad-news-1513802334.

Matousek, Mark. “The Most Impressive Things Tesla's Cars Can Do in Autopilot.” *Business Insider*, Business Insider, 29 Jan. 2018 (I), www.businessinsider.com/tesla-autopilot-functions-and-technology-2017-12?_ga=2.123596747.1368268828.1520766349-1819051482.1520766349.

Matousek, Mark. “These 6 Electric Cars Will Pose the Biggest Threat to Tesla's Model 3.” *Business Insider*, Business Insider, 23 Jan. 2018 (II), www.businessinsider.com/electric-cars-challenging-tesla-model-3-2018-1.

Maurer, Bill. “Tesla Model 3 Production Stalled?” *Seeking Alpha*, Seeking Alpha, 1 Mar. 2018, seekingalpha.com/article/4152268-tesla-model-3-production-stalled.

McEachern, Sam. “Known Short Seller Says Tesla Stock Is 'Worthless' » AutoGuide.com News.” *AutoGuide.com News*, AutoGuide, 15 Dec. 2017, www.autoguide.com/auto-news/2017/12/known-short-seller-says-tesla-stock-worthless.html.

Melin, Anders, and Dana Hull. “Musk Probably Won't Move to Mars After $2.6 Billion Pay Approved.” *Bloomberg.com*, Bloomberg, 21 Mar. 2018, www.bloomberg.com/news/articles/2018-03-21/tesla-investors-are-said-to-approve-2-6-billion-award-for-musk.

Morgan Stanley Research Center. “Auto Industry Braces for Electric Shock.” *Morgan Stanley*, Morgan Stanley, 2017 (I), https://www.morganstanley.com/ideas/electric-car-supply-chain.

Morgan Stanley Research Center. “On the Charge.” *Morgan Stanley*, Morgan Stanley, Aug 2017 (II), https://www.docdroid.net/A5uNOPX/on-the-charge.pdf.

Morris, Charles. “Only Seven Years After Going Public, Tesla's Market Cap Surpasses Ford.” *InsideEVs.com*, 10 Feb. 2018, insideevs.com/seven-years-ipo-tesla-market-cap-surpasses-ford/.

Morris, Langdon. “Business Model Warfare: The Strategy of Business Breakthroughs.” *Journal of Business Models*, 2013, Vol. 1, No. 1, pp. 13-17, https://journals.aau.dk/index.php/JOBM/article/view/617/486.

Murray, Charles. “China, Tesla Will Set Pace of EV Battery Production in 2018.” *Design News*, 3 Jan. 2018, www.designnews.com/electronics-test/china-tesla-will-set-pace-ev-battery-production-2018/135544123657939.

NIO. “U.S. Electric Car in 2020.” *NIO*, 10 Mar. 2017, www.nio.io/news/nio-us-electric-car-2020.

OICA. “Sales Statistics.” *OICA*, 2018, www.oica.net/category/sales-statistics/.

O'Kane, Sean. “Inside Faraday Future's Financial House of Cards.” *The Verge*, The Verge, 12 Dec. 2017, www.theverge.com/transportation/2017/12/12/16651026/faraday-future-investigation-money-debt-finances-yueting.

Peake, Eleanor. “New Tesla Semi Electric Truck Has Got a Whole Convoy of Competition.” *WIRED*, WIRED UK, 17 Nov. 2017, www.wired.co.uk/article/new-tesla-semi-electric-truck-elon-musk.

Polson, Jim. “U.S. Solar Companies Are Having Their Best Day in Weeks.” *Bloomberg.com*, Bloomberg, 20 Mar. 2018, www.bloomberg.com/news/articles/2018-03-20/u-s-solar-companies-are-having-their-best-day-in-weeks?utm_source=facebook&utm_medium=social&utm_campaign=socialflow-organic&cmpid=socialflow-facebook-markets&utm_content=markets.

Pontes, Jose. “BAIC EC180 Shines (China Electric Car Sales Report).” *CleanTechnica*, 26 May 2017, cleantechnica.com/2017/05/25/baic-ec180-shines-china-electric-car-sales-report/.

Pontes, Jose. “2017 Global Sales by OEM.” *EV Sales*, 29 Jan. 2018, ev-sales.blogspot.cz/2018/01/2017-global-sales-by-oem.html.

Q-Series: UBS Evidence Lab. “Electric Car Teardown – Disruption Ahead?” *UBS*. UBS, 18 May 2017, http://www.iom3.org/sites/default/files/news-documents/Automotive_Materials_EV_UBS_May_2017.pdf.

Randall, Tom. “Tesla's $169 Million Battery Play Is Just the Beginning.” *Bloomberg.com*, Bloomberg, 17 Mar. 2017, www.bloomberg.com/news/articles/2017-03-17/tesla-s-169-million-battery-play-is-just-the-beginning#footnote-1489707159432.

Riesen, Robert. “5 Reasons To Sell Tesla Now.” *Seeking Alpha*, Seeking Alpha, 5 Mar. 2018, seekingalpha.com/article/4153312-5-reasons-sell-tesla-now.

Rosenbaum Joshua & Perl Joshua. “Investment Banking: Valuation, Leveraged Buyouts, and Mergers & Acquisitions.” *John Wiley & Sons, Inc.,* 2013, ISBN 978-1-118-65621-1.

Salzman, Avi. “Tesla's Key Advantages Over the Big Automakers.” *Barron's*, Barrons, 14 Aug. 2017, www.barrons.com/articles/teslas-key-advantages-over-the-big-automakers-1502733760.

Shaban, Hamza. “For $200,000, Tesla Will Sell You The 'World's Fastest' Consumer Car.” *NDTV.com*, NDTV.com, 18 Nov. 2017, www.ndtv.com/world-news/for-200-000-tesla-will-sell-you-the-worlds-fastest-consumer-car-1777022.

Shameen, Assif. “3 Top Picks in Asian EV Battery Makers.” *Barron's*, Barrons, 18 Nov. 2017, www.barrons.com/articles/3-top-picks-in-asian-ev-battery-makers-1510932616.

Siu, Jason, and Ray Prince. “Tesla Teases Model Y.” *HybridCars.com*, 7 June 2017, www.hybridcars.com/tesla-teases-model-y/.

Smith, Grant. “IEA Sees American Energy Dominance Squeezing OPEC Into 2020s.” *Bloomberg.com*, Bloomberg, 5 Mar. 2018, www.bloomberg.com/news/articles/2018-03-05/iea-sees-american-energy-dominance-squeezing-opec-into-2020s.

Smith, Molly. “Tesla Bonds Are in Free Fall.” *Bloomberg.com*, Bloomberg, 28 Mar. 2018, www.bloomberg.com/news/articles/2018-03-28/tesla-bonds-down-to-86-cents-start-to-flash-warning-signals.

Stewart, Jack. “Tesla's Latest Chinese Competitor Takes Screens to an Extreme.” *Wired*, Conde Nast, 9 Jan. 2018, www.wired.com/story/byton-tesla-latest-chinese-competitor-takes-screens-to-an-extreme/.

Tesla Inc. “Annual Report 2017 10-K.” *Tesla Inc.*, Tesla Inc., 22 Feb. 2018, ir.tesla.com/secfiling.cfm?filingid=1564590-17-3118&cik=1318605.

Thompson, Cadie. “Subaru Might Be Quietly Building a Tesla-Killer.” *Business Insider*, Business Insider, 12 Aug. 2016, www.businessinsider.com/subaru-electric-crossover-report-2016-8.

Tiernan, Ray. “Nvidia's Huang Says Partnership with Audi to Bring 'Level 4 Autonomy' by 2020.” *Barron's*, Barrons, 5 Jan. 2017, www.barrons.com/articles/waiting-for-nvidia-1483581030.

Tillier, Martin. “Long-Term Investors Should Keep on Trucking.” *NASDAQ.com*, Nasdaq, 19 Dec. 2017, www.nasdaq.com/article/longterm-investors-should-keep-on-trucking-cm893856.

Trefis Team. “How Is Tesla's Solar Business Faring?” *Forbes*, Forbes Magazine, 19 Dec. 2017, www.forbes.com/sites/greatspeculations/2017/12/19/how-is-teslas-solar-business-faring/2/.

Turpen, Aaron. “How Tesla’s Semi Will Dramatically Alter the Trucking Industry.” *Teslarati.com*, 21 Dec. 2017, www.teslarati.com/tesla-semi-dramatically-alters-trucking-industry/.

ValueAnalyst Value. “Tesla: Revising Model S And X Projections.” *Seeking Alpha*, Seeking Alpha, 21 Feb. 2018, seekingalpha.com/article/4148925-tesla-revising-model-s-x-projections.

Veldhoen, Steven. “Booz & Company Announce Its Ninth Annual Global Innovation 1000 Study: China National Petroleum Corporation and ZTE Enter Top 100.” *Strategy& - the Global Strategy Consulting Team at PwC*, 28 Oct. 2013, www.strategyand.pwc.com/cn/home/press/press-releases/displays/2013-global-innovation-1000-cne.

Wahlman, Anton. “Tesla's Sales Collapse In Europe: Down 63% This Quarter.” *Seeking Alpha*, Seeking Alpha, 9 Mar. 2018, seekingalpha.com/article/4155182-teslas-sales-collapse-europe-63-percent-quarter.

Zetlin, Minda. “Surprise! Volkswagen's New Electric Car for Will Go Farther and Cost Less Than the Tesla 3.” *Inc.com*, Inc., 29 Sept. 2016, www.inc.com/minda-zetlin/surprise-volkswagens-new-electric-car-for-will-go-farther-and-cost-less-than-th.html?cid=search.

Appendix

Table 1: Future actions in the car market by countries, expected growth in the market and own predictions

Current and Future Actions / Main Sales Drivers / Information of Research Papers	Expected Growth Rates / Rates by Research Papers	Own predictions
Total		
Tighter emission regulations → future regulations will cause $3.000 - $4.000 extra costs per gasoline car Regulations also focused on Nitrogen oxide (Nox) emissions → additional costs for gasoline and plug-in hybrid cars → supportive for BEV sales Declining battery production costs Increasing consumer interest Shared mobility Autonomous driving Global customer preference for larger (and so higher emissions) SUV Gradual but accelerating decline of diesel UBS Research Paper 2017 Total costs of operation parity expectations (break-even point): Europe: 2018 China: 2023 U.S.: 2025 With 5%-margin (margin considered "normal over-the-cycle margin for this vehicle type"): Europe: 2023 China: 2026 (excluding subsidies) U.S.: 2027 Total sales volumes of UBS forecast revealed rather too low → UBS forecast considered rather conservative and for own prediction rather stick with growth rates as a reference Current ratio of BEV to PHEV is 60:40 → By 2025: PHEV will decrease to 20% as BEV become more competitive Morgan Stanley Research Paper 2017 Growth and sales numbers based on Morgan Stanley's base case figures PHEV expected to grow quickly through 2020, but sales decreasing sharply as soon as battery Evs reach price parity with gasoline vehicles and OEMs start focusing on BEVs Blackrock Research Paper 2017 Expects EV sales to exceed ICE sales in Ipprox.. a decade	**EV sales / all vehicles annual** Morgan Stanley 2025: 9% 2030: 16% 2040: 64% 2050: 90% (almost 80%) UBS 2018: 1,3% 2019:1,6% 2020: 2,1% 2021:3,1% 2022:4,5% 2023:6,5% 2024: 9,4% 2025: 13,7% → '17 – '25 CAGR: 39,7% **Total EV sales per year** UBS 2019:1,588 million 2020:2,118 million 2021: 3,103 million 2022:4,584 million 2023:6,657 million 2024:9,722 million 2025: 14,2 million → '18 – '25 CAGR: 39,7% **Overall BEV fleet** Morgan Stanley 2025: 2,6% of total fleet 2030: 15 million BEV (6,6%) 2040: 27% of total fleet 2050: 1 billion BEV (57%) **Total car sales** Morgan Stanley 2017: 90 million 2050: 134 million vehicles and total car fleet of 2 billion	**YoY-Growth rates:** 2018: 46,3% 2019:48,3% 2020:52,5% 2021:37,3% 2022:35,2% 2023:34,3% 2024:31,7% 2025:31,5% 2026:25,8% 2027:20,4% **EV sales / all vehicles** 2018: 2,5% 2019:3,7% 2020:5,5% 2021:7,5% 2022:10,0% 2023:13,3% 2024:17,3% 2025:22,5% 2026:28,1% 2027:33,4% **Total EV sales per year** 2018: 1.789.700 2019: 2.653.740 2020: 4.047.737 2021:5.555.657 2022: 7.511.517 2023: 10.086.964 2024: 13.280.721 2025: 17.461.075 2026: 21.970.450 2027: 26.442.476 →'17–'27 CAGR: 36,0%
China		
Annual sales target of 2 million EV units by 2020 and 7 million EV units by 2025 Introduction of legislation which requires all car manufacturers with import or production volume above 50.000 passenger vehicles to fulfill specific sales quota of zero and low emission vehicles → 2019: 8% of overall deliveries being NEV, 2020 – 10%, 2021 – 12%, 2025 – 20% Non-monetary incentives: license plate lottery system exemptions in large cities, free installation of public charging piles Currently strong subsidies but in the future thinner subsidies Phase out monetary subsidies by 2020 and substitution by non-monetary subsidies	**EV sales / all vehicles annual** Morgan Stanley 2025: 20% UBS 2018: 1,7% and yoy:25% 2019:2,0% and yoy:20% 2020: 2,4% and yoy:25% 2021:3,5% and yoy:45% 2022:5,1% and yoy:45% 2023: 7,4% and yoy:45% 2024:10,7% and yoy:45% 2025: 15,5% and yoy:45% → '17 – '25 CAGR: 36,5% **EV sales China / EV sales world** 2030: up to 40% **Total sales per year**	**EV sales / all vehicles & YoY – growth** 2018: 3,9% & 65,0% 2019: 6,2% & 60,0% 2020: 9,6% & 60,0% 2021: 12,5% & 32,5% 2022: 15,6% & 27,5% 2023: 19,2% & 25,0% 2024: 22,5% & 20,0% 2025: 26,5% & 20,0% 2026: 30,6% 18,0% 2027: 35,1% & 17,0% **Total sales per year** 2018: 999.900 2019: 1.599.840

Current and Future Actions / Main Sales Drivers / Information of Research Papers	Expected Growth Rates / Rates by Research Papers	Own predictions
By 2025 Chinese companies will start exporting cars New regulations in 2018 regarding subsidies puts stronger support on long-range BEVs while decreasing support on low-range BEV and PHEV → push towards full BEV market Stronger regulations pushing car manufacturers to further developments in the BEV market Local subsidy policies are continuing but under stronger regulations In 2018: China will remove current restrictions for NEV foreign automakers' investments allowing them to invest in wholly owned subsidiaries rather than setting up a 50-50 joint venture in 2018 →higher competition in the market → impact of reforms expected to be visible in the 2020's.	2019:605.000 2021:1.096.000 2023: 2.305.000 2025: 4.846.000	2020: 2.559.744 2021: 3.391.661 2022:4.324.368 2023:5.405.459 2024:6.486.551 2025: 7.783.862 2026: 9.184.957 2027: 10.746.399 →'17–'27 CAGR: 33,3%
Europe		
Overall: Further reductions in CO2 emissions France: Full phase out of ICE engines by 2040, since July 2016 ban of diesel cars in Paris during specific weather conditions UK: Full phase out of ICE engines by 2040, introduce low emission zones and ban of diesel cars Germany: currently no EV sales targets, no position in potential phase out of ICE engines court agreement to ban diesel cars out of cities with high pollution → sensitivity of population for these issues is growing, but reduction of subsidies expected in the future Norway: The government announced plans for 100% EV sales ratio in 2025	**UBS Research Paper** **EV sales / all vehicles annual** 2018: 1,7% and yoy: 30% 2019:2,4% and yoy: 40% 2020:3,5% and yoy: 55% 2021:5,5% and yoy: 60% 2022:9,1% and yoy: 60% 2023:13,6% and yoy: 50% 2024:20,4% and yoy: 50% 2025: 30,6% & yoy: 50% → '17 – '25 CAGR: 48,4% **Total sales per year** 2019:489.000 2021:1.173.000 2023: 2.815.000 2025: 6.335.000	**EV sales / all vehicles & YoY – growth** 2018: 2,2% & 30,0% 2019: 3,1% & 45,0% 2020: 4,7% & 55,0% 2021: 7,2% & 55,0% 2022: 10,9% & 55,0% 2023: 16,3% & 52,5% 2024: 23,5% & 47,5% 2025: 32,8% & 42,5% 2026: 41,8% & 30,0% 2027:49,1% & 20,0% **Total sales per year** 2018: 400.400 2019: 580.580 2020: 899.899 2021: 1.394.843 2022: 2.162.007 2023: 3.297.061 2024: 4.863.165 2025: 6.930.011 2026: 9.009.014 2027: 10.810.816 →'17–'27 CAGR: 33,3%
U.S.		
Government about to relax fuel economy rules, but no significant influence expected on EV sales figures according to Blackrock Research Paper But many states own rules of stricter regulations → low or no impact of relaxed laws → other factors like diminishing costs and higher demand more influence on sales than laws	**UBS Research Paper** **EV sales / all vehicles annual** 2018: 1,3% and yoy: 20% 2019: 1,6% and yoy: 20% 2020:1,9% and yoy: 20% 2021:2,2% and yoy: 20% 2022:2,6% and yoy: 20% 2023:3,3% and yoy: 25% 2024:4,1% and yoy: 25% 2025:5,1% and yoy: 25% → '17 – '25 CAGR: 21,8% **Total sales per year** 2019:275.000 2021:396.000 2023: 594.000 2025: 928.000	**EV sales / all vehicles & YoY – growth** 2018: 3,9% & 17,0% 2020: 5,4% & 16,0% 2022: 7,9% & 20,0% 2024: 12,1% & 23,0% 2026: 19,9% & 25,0% 2027: 23,6% & 17,0% **Total sales per year** 2018: 234.000 2020:314.870 2022:445.856 2024:663.568 2026:1.057.562 2027:1.237.347 →'17–'27 CAGR: 20,0%
Japan		
No future actions available and future market considered to be very small	**UBS Research Paper** **EV sales / all vehicles annual** 2018: 1,4% and yoy: 40% 2019: 1,7% and yoy: 20% 2020:2,2% and yoy: 30% 2021:3,0% and yoy: 40% 2022:4,2% and yoy: 40% 2023: 5,9% and yoy: 40%	**EV sales / all vehicles & YoY – growth** 2018:1,8% & 40,0% 2020:2,8% & 30,0% 2022:5,7% & 40,0% 2024: 12,1% & 50,0% 2026: 25,7% & 40,0% 2027: 32,3% & 25,0%

Current and Future Actions / Main Sales Drivers / Information of Research Papers	Expected Growth Rates / Rates by Research Papers	Own predictions
	2024: 8,9% and yoy: 50% 2025: 13,3% and yoy:50% → '17 – '25 CAGR: 38,5% **Total sales per year** 2019:80.000 2021:145.000 2023: 284.000 2025: 638.000	**Total sales per year** 2018: 78.400 2020: 122.304 2022: 239.716 2024: 503.403 2026: 1.057.147 2027: 1.321.434 →'17–'27 CAGR: 37,2%
Rest of the World (ROW)		
No future actions available	**UBS Research Paper** **EV sales / all vehicles annual** 2018: 0,4% and yoy: 40% 2019:0,5% and yoy: 40% 2020:0,7% and yoy: 40% 2021:1,1% and yoy: 50% 2022:1,6% and yoy: 50% 2023:2,4% and yoy: 50% 2024:3,5% and yoy: 50% 2025:5,2% and yoy: 50% → '17 – '25 CAGR: 46,2% **Total sales per year** 2019: 140.000 2021: 293.000 2023: 659.000 2025: 1.484.000	**EV sales / all vehicles & YoY – growth** 2018: 0,4% & 40,0% 2020: 0,9% & 40,0% 2022: 1,9% & 50,0% 2024:4,4% & 50,0% 2026:9,6% & 45,0% 2027:13,5% & 40,0% **Total sales per year** 2018: 77.000 2020: 150.920 2022: 339.570 2024: 764.033 2026:1.661.771 2027: 2.326.479 →'17–'27 CAGR: 45,4%

Table 2: Total electric vehicle market sales analysis by company

Car Manufacturer	2016	2017	CAGR ('15 – '17)
BYD	**102.115**	**113.795**	**35,81%**
%-yoy-growth	65,50%	11,44%	
%-margin of total EV sales	13,20%	9,30%	
BAIC	**46.416**	**104.006**	**145,56%**
%-yoy-growth	169,11%	124,07%	
%-margin of total EV sales	6,00%	8,50%	
Tesla	**76.586**	**103.082**	**42,64%**
%-yoy-growth	51,16%	34,60%	
%-margin of total EV sales	9,90%	8,40%	
%-margin of vehicle sales of OEM	100%	100%	
BMW Group	**58.794**	**103.080**	**72,86%**
%-yoy-growth	70,44%	75,33%	
%-margin of total EV sales	7,60%	8,40%	
%-margin of vehicle sales of OEM	2,48%	4,18%	
Nissan – Renault Alliance	**84.322**	**89.323**	**11,21%**
%-yoy-growth	16,75%	5,93%	
%-margin of total EV sales	10,90%	7,30%	
%-margin of vehicle sales of OEM	0,96%	0,93%	
Volkswagen Group	**63.435**	**70.969**	**32,50%**
%-yoy-growth	56,92%	11,88%	
%-margin of total EV sales	8,20%	5,80%	
%-margin of vehicle sales of OEM	0,62%	0,66%	
Geely	**17.019**	**67.298**	**53,49%**
%-yoy-growth	-40,42%	295,42%	
%-margin of total EV sales	2,20%	5,50%	
%-margin of vehicle sales of OEM	2,22%	5,40%	
SAIC	**20.114**	**56.286**	**122,99%**
%-yoy-growth	77,70%	179,84%	
%-margin of total EV sales	2,60%	4,60%	
%-margin of vehicle sales of OEM	0,31%	0,81%	
General Motors	**32.491**	**53.838**	**60,04%**
%-yoy-growth	54,57%	65,70%	
%-margin of total EV sales	4,20%	4,40%	
%-margin of vehicle sales of OEM	0,32%	0,56%	
Hyundai – Kia	**16.246**	**36.708**	**113,08%**
%-yoy-growth	100,94%	125,96%	
%-margin of total EV sales	2,10%	3,00%	
%-margin of vehicle sales of OEM	0,21%	0,51%	
Mercedes Benz	**20.887**	**36.708**	**84,53%**
%-yoy-growth	93,76%	75,74%	
%-margin of total EV sales	2,70%	3,00%	
%-margin of vehicle sales of OEM	1,00%	1,60%	

Table 3: Battery electric vehicle market sales analysis by company

Car Manufacturer	2016	2017	CAGR ('15 – '17)
Total	**413.630**	**700.192**	**72,2%**
%-yoy-growth	75,3%	69,3%	
%-margin of total EV sales	59,5%	64,3%	
BAIC	**38.501**	**103.516**	**143,0%**
%-yoy-growth	119,6%	168,9%	
%-margin of total BEV sales	9,3%	14,8%	
%-margin of company's EV sales	100%	100%	
Tesla	**76.586**	**103.082**	**42,64%**
%-yoy-growth	51,16%	34,60%	
%-margin of total BEV sales	18,10%	14,70%	
%-margin of company's EV sales	100%	100%	
Nissan – Renault Alliance	**76.445**	**83.858**	**11,1%**
%-yoy-growth	12,61%	9,70%	
%-margin of total BEV sales	18,48%	11,98%	
%-margin of company's EV sales	90,66%	93,88%	
BYD	**46.908**	**42.715**	**110,7%**
%-yoy-growth	387,7%	-8,9%	
%-margin of total BEV sales	11,3%	6,1%	
%-margin of company's EV sales	50,4%	48,5%	
Geely	**24.043**	**28.265**	**281,2%**
%-yoy-growth	1136,1%	17,6%	
%-margin of total BEV sales	5,8%	4,0%	
%-margin of company's EV sales	67,8%	92,1%	
General Motors	**3.769**	**26.013**	**210,2%**
%-yoy-growth	39,4%	590,2%	
%-margin of total BEV sales	0,9%	3,7%	
%-margin of company's EV sales	11,6%	50,6%	
BMW Group	**19.892**	**23.368**	**8,9%**
%-yoy-growth	0,9%	17,5%	
%-margin of total BEV sales	4,8%	3,3%	
%-margin of company's EV sales	36,3%	28,0%	
SAIC	**1.496**	**21.934**	**576,0%**
%-yoy-growth	211,7%	1366,2%	
%-margin of total BEV sales	0,4%	3,1%	
%-margin of company's EV sales	9,0%	37,4%	
Volkswagen	**13.023**	**19.269**	**3,7%**
%-yoy-growth	-27,4%	48,0%	
%-margin of total BEV sales	3,1%	2,8%	
%-margin of company's EV sales	22,0%	29,8%	
Hyundai – Kia	**12.076**	**25.157**	**88,8%**
%-yoy-growth	71,0%	108,3%	
%-margin of total BEV sales	2,9%	3,6%	
%-margin of company's EV sales	73,2%	72,6%	
Daimler & Daimler – BYD & Smart	**6.373**	**9.317**	**9,1%**
%-yoy-growth	-18,6%	46,2%	
%-margin of total BEV sales	1,5%	1,3%	
%-margin of company's EV sales	29,0%	29,5%	

Table 4: Competitor analysis and comparison to Tesla

Brands / Models	Features / Explanations	Current Comparison to Tesla
Volkswagen	Strong branding of VW	UBS: High EV sales potential and high investment focus on EV
Investments	EV Platform together with Audi and Porsche mainly Electric offensive 2030: Roll-out offensive starts in 2020-2021 with two models Goal: 20-25% of overall sales by 2025 (2-3 million EV sales)	Holds net cash of €25 billion Spendings of $84 billion (7-times Tesla's current revenues)
Current models	Battery electric vehicles: e-Golf: 2017 – 16.573 sales → range of 125 miles & $38.500 (56,9% yoy) e-up!: 2017 – 2.696 sales (9,7% yoy-growth) Plug-In hybrid electric vehicles: Passat GT: 2017 – 13.429 sales (2,4% yoy growth) Golf GTE: 2017 – 8.998 sales (-30,6% yoy growth)	Tesla competitive advantage to current models, but growing competition from 2020 on (I.D. release)
Audi	One of the leading companies in autonomous driving, Audi A8 was first car to offer level 3 autonomous driving 74% together with Audi and Daimler in map service Here → leading company in field of dynamic maps Cooperation with Nvidia	Strong branding of Audi UBS: High EV sales potential and high investment focus on EV
Investments	EV Platform together with Audi and Porsche mainly Three new electric vehicles until 2020 in premium and luxury segment 20 electrified models by 2025, with ten being fully electric Goal: 20-25% of overall sales by 2025	
Current models	Plug-In hybrid electric vehicles: A3 e-tron: 2017 – 11.613 (-0,1% yoy growth) Q7 e-tron: 2017 – 3.713 (-4,2% yoy growth)	Tesla currently competitive advantage over Audi in EV, but growing competition from 2020 on
BMW	Joint venture in China with Great Wall in 2018 and sales of cars under own brand Zinorr (the latter was not successful) Ionity: Project to install fast charger network along Europ. Highways Cooperation with Nvidia	Strong branding of BMW UBS: very high EV sales potential and medium investment focus
Investments	Goal: twelve electric vehicles by 2025 74% together with Audi and Daimler in map service Here → leading company in field of dynamic maps	Cash and marketable securities of almost €20 billion
Current models	Battery electric vehicles: I3: 2017 – 23.368 (17,5% yoy growth) → range of 81 miles & $43.395 starting price Plug-In hybrid electric vehicles: 330e: 2017 – 14.219 (46,9% yoy growth) X5 xDrive: 2017 – 11.391 (-2,4% yoy growth) 225xe: 2017 – 9.718 (69.2% yoy growth)	Tesla competitive advantage in battery electric vehicle market and Plug-in market of BMW more successful but Tesla considered to be superior overall, but growing competition from 2025 on
Daimler (car brand: Mercedes-Benz & Smart)	74% together with Audi and Daimler in map service Here → leading company in field of dynamic maps Ionity: Project to install fast charger network along Europ. Highways Cooperation with Nvidia	Mercedes strong branding UBS. Very high EV sales potential & high investment focus on EV
Investments	Investment volume for EV market of $10 billion Announcement to invest $1 billion by 2022 to offer electrified models for the entire portfolio Almost $2 billion investment in new plant in China with BAIC €100 million investment in Bangkok with local partner TAAP to enhance montage facility and for new battery production facility Goal: Offer one electrified version of each model by 2022 Goal: 15-20% of overall sales by 2025	High investment amount by Mercedes → currently Tesla competitive advantage but growing competition starting from 2022
Current models	Especially considered to be close competitor of Tesla in commercial vehicle segment if Tesla is introducing its Semi Truck Put electric trucks in production e-Actro: fourth electric commercial truck of Daimler with roll-out date	Tesla competitive advantage in EV market, but close competitors in commercial vehicle market after roll-out

Brands / Models	Features / Explanations	Current Comparison to Tesla
	comparable to Tesla's Semi Truck	of Semi-Truck
General Motors	Manufactures and sells EV mainly under brand Chevrolet Cooperation with SAIC in China through brand Baojun	UBS: Medium EV sales potential & medium investment focus on EV
Investments	High investments into autonomous driving → 110 autonomous cars in California on the road → highest amount of all companies New model of Bolt Investments mainly in the U.S. and no concrete expansion plans	Low investments and low focus on EV in the future → Tesla will increase competitive advantage
Current models	Battery electric vehicles: Chevrolet Bolt: 2017 – 25.982 (4318,7% yoy growth) → range of 238 miles & $37.500, almost 100% of sales in the U.S. Plug-In hybrid electric vehicles: Chevrolet: 2017 – 24.723 (-12,5% yoy growth) Opel: 2017 – 629 (1397,6 yoy growth)	Strong competition in home U.S. market with Tesla, explicitly Model 3, but Model 3 assessed superior due to slightly lower price and better features
Volvo	Owned by Chinese electric vehicle manufacturer Geely Currently no BEV sales, only PHEV sales Cooperation with Nvidia	UBS: very high EV sales potential & medium investment focus on EV
Investments	All roll-outs after 2019 either battery or plug-in hybrid electric vehicles Goal: one million electric car sales by 2025	→ growing competition from 2020 on
Current models	Plug-In hybrid electric vehicles: Total: 2017 – 13.915 (-14,9% yoy growth)	Tesla strong advantage over Volvo
Nissan – Renault	Strengthen alliance with Renault and talks about merger of both companies	UBS: high EV sales potential & high investment focus on EV
Investments	Investments into mutual EV platform for both companies Investments into new version of Leaf for 2018 Strengthen alliance with Renault and talks about merger of both companies	As soon as Tesla strives stronger into Europ. Market then strong competition → shares stay same so far
Current models	Battery electric vehicles: Nissan Leaf: 2017 – 45.924 (-5,4% yoy growth) → range of 107 miles & $29.990 starting price → 2017: most sold EV in market Nissan NV200: 2017 – 2.039 (-1,6% yoy growth) Renault Zoe: 2017 – 31.046 → seconds highest BEV sales in Europe	Already currently very strong competition to Tesla with Leaf and Zoe, but in different but in different markets (U.S. vs. Europe)
Toyota	Signed agreement with Mazda for development of Evs Partnership with Nvidia to improve self-driving abilities in car	UBS: High EV sales potential & medium investment focus on EV
Investments	Investments into production of batteries that store more power and recharge faster than current lithium-ion batteries First battery EV by 2020	Stronger competition starting from 2020, but Tesla still considered superior → future gain of shares
Current models	No battery electric vehicles currently with stop of production of RAV4 Plug-In hybrid electric vehicles: Total: 2017 – 50.417 (1456% yoy growth) from 3.236 sales in 2016	Tesla competitive advantage in EV market due to BEV sales and future disappearance of PHEV
BYD		Own assessment: High sales potential and medium investment focus on EV
Investments	Additional production facility opening in June 2018 in China for in-house production of lithium-ion batteries E-bus facility in India for Indian and neighbor markets Goal: 16 BEVs and 5 PHEVs by 2021 and production facility reaching battery capacity of 34 GWh by 2020	
Current models	Battery electric vehicles: → only sales market is China Total BEV: 2017 – 42.715 (-6,9% yoy growth) E5: 2017 – 23.601 (50,9% yoy growth) E6: 2017 – 10.215 (-50,4% yoy growth) → SUV, mainly used in Asian taxi fleeds Plug-In hybrid electric vehicles: → only sales market is China Total PHEV: 2017 – 66.241 (24,3% yoy growth) Song: 2017 – 30.911 (46,7% yoy growth)	

Brands / Models	Features / Explanations	Current Comparison to Tesla
	Qin: 2017 – 20.738 (-5,2% yoy growth)	
BAIC	Fifth biggest car manufacturer in China Purely focused on BEVs through daughter company BJEV Also plans to support Daimler with its electric expansion in China	Own assessment: very high EV sales potential & very high investment focus on EV
Investments	Cooperation with Daimler to produce EV → investment of almost $2 billion into factory in China Investment of $150 million into Mexico within next five years Investment in vehicle assembly plant in South Africa	Strong investments & partnerships → serious competitor in future → some competition in future
Current models	Battery electric vehicles: Total: 104.006 (34,6% yoy growth) → biggest BEV manufacturer worldwide but sales only in China EC180: 2017 – 77.645 (introduced in 2017) → range of 112 miles, 62 mph top speed & price around $24.000 D50: 2017 – 13.258 (-30,3% yoy growth) Senova D20: 2017 – 5.415 (-71,2% yoy growth)	Significantly cheaper which is important for Chinese market → competitive advantage to Tesla in Chinese market, but if Tesla will be able to enter market without tariffs → advantage Tesla → both companies equal → shares stay same
Geely	Combined EV sales total almost 103.200 units → one of the biggest players in the EV market Sales from Geely, Zhidou, Volvo, Lynk & Co., Lotus and others → company owns almost as many brands as Volkswagen Company also active in field of technology	Own assessment: high EV sales potential & very high investment focus on EV → very aggressive investments but assess how sustainable
Investments	9,7% stake in Daimler for $9 billion → biggest single shareholder → access to technologies 2017: 49.9% stake in Malaysian car manufacturer PROTON 2017: 51% stake in Lotus Cars	Significantly cheaper which is important for Chinese market → competitive advantage to Tesla in Chinese market
Current models	Battery electric vehicles: Emgrand EC7 EV: 2017 – 23.324 (35,6% yoy growth) → range of 93 miles & price before (after) subsidies of $33.830 ($14.460)	But if Tesla will be able to enter market without tariffs → advantage Tesla → both companies equal → shares stay same
SAIC	Biggest car manufacturer in China → EV sales only in China Owns car manufacturer Roewe under which brand it sells Evs Announcement of future joint venture plans with Infineon to improve autonomous driving abilities Collaboration with Alibaba	Own assessment: high EV sales potential & medium investment focus on EV
Investments	Goal: EV sales volume of 600.000 units by 2021 and by 2021 roll out of 13 BEVs and 17 PHEVs	Significantly cheaper which is important for Chinese market → competitive advantage to Tesla in Chinese market
Current models	Battery electric vehicles: SAIC-GM-Wuling Baojun E100: Roll-out in 2017 – 11.466 → price before (after) subsidies of $15.000 ($7.300) Plug-In hybrid electric vehicles: SAIC Roewe eRX5: Roll-out in 2017 – 10.436 → range of 38 miles and price before (after) subsidies of $42.000 ($33.150)	But if Tesla will be able to enter market without tariffs → advantage Tesla → market share gain for Tesla
NIO	Chinese EV startup backed by tech companies Tencent and Baidu and America based Sequoia Capital 2020: launch of all vehicles in the U.S. (currently only China)	Own assumptions: very high EV sales potential & very high investment focus on EV
Investments	Partnerships with Mobileye, Nvidia and NXP NIO Eve concept → voice activated artificial intelligence digital companion called NOMI → personalize driving experience based on road conditions and activities	Strong competition starting from 2018 and very strong competition from 2020 on → Tesla can lose market share to NIO from 2020 on
Current models	ES8: SUV with launch in 2017 and starting price of $67.700 ,all-wheel drive and 0-60 mph in 4,4 seconds with range of 220 miles, incorporates artificial intelligence system with ability to charge battery in three	Superior features than Model X but VIIIpprox.. half price of Tesla's Model

Brands / Models	Features / Explanations	Current Comparison to Tesla
	minutes	X (even before Chinese subsidies) → competitive advantage over Tesla
Byton	Relatively new but promising Chinese EV startup	-
Investments	-	-
Current models	In 2017 introduced first BEV with starting price of $45.000 and launch in China in 2019 → range of up to 300 miles, 49-inch screen from one door to the other, hidden door handles and no side mirrors plus 10-inch screen in steering wheel, 80% chargeable in 30 minutes International deliveries planned for 2020	In overall future competition hard to assess as company has to establish itself first, but good to know about Byton

Table 5: Sales-to-capital ratio calculation automotive segment

Automotive ($, in mil.)	BMW	VW	AUDI	Geely	BYD	BAIC	GM	Renault	Daimler	Volvo	Toyota
Revenues	111.479	260.607	67.928	13.742	15.207	19.875	145.588	66.394	185.648	39.236	255.286
/ (BV Total Debt	112.475	196.526	6.362	360	8.685	4.864	98.818	60.317	125.783	15.609	172.293
+ BV Total Equity	65.578	131.132	33.867	5.350	9.215	9.166	36.200	40.204	78.521	13.328	167.720
- Cash & Cash Equiv.	10.867	22.189	13.552	2.062	1.373	5.660	15.512	16.899	14.513	4.413	26.908
– Market. Securities)	0	19.162	7.216	0	0	0	8.313	0	10.908	22	16.365
Sales / Capital (2017)	**0,67**	**0,91**	**3,49**	**3,77**	**0,92**	**2,37**	**1,31**	**0,79**	**1,04**	**1,60**	**0,86**

Table 6: Sales-to-capital ratio calculation internet media segment

Internet Media ($, in mil.)	Alphabet	BAIDU	Alibaba	Facebook
Revenues	110.855	12.564	23.531	40.653
/ (BV Total Debt	3.969	6.696	13.338	0
+ BV Total Equity	152.502	20.037	47.127	74.347
- Cash & Cash Equiv.	10.715	1.704	20.899	8.079
– Market. Securities)	91.156	91.156	589	33.632
Sales / Capital (2017)	**2,03**	**-0,19**	**0,60**	**1,25**

Table 7: Sales-to-capital ratio calculation energy storage segment

Energy Storage ($, in mil.)	AES	ABB	LG Chem	Hitachi	Ameresco
Revenues	10.530	34.312	22.739	84.755	717
/ (BV Total Debt	19.965	7.447	2.853	10.571	196
+ BV Total Equity	5.682	15.349	15.308	36.807	347
- Cash & Cash Equiv.	949	4.526	2.107	6.875	24
– Market. Securities)	0	1.102	0	0	0
Sales / Capital (2017)	**0,43**	**2,00**	**1,42**	**2,09**	**1,38**

Table 8: Sales-to-capital ratio calculation energy generation segment

Energy Generation ($, in mil.)	SunPower	Sunrun	Solaredge	FirstSolar	JASolar
Revenues	1.872	530	607	2.941	2.913
/ (BV Total Debt	1.605	1.061	0	394	917
+ BV Total Equity	262	1.290	398	5.099	1.040
- Cash & Cash Equiv.	435	203	163	2.269	227
– Market. Securities)	0	0	77	720	0
Sales / Capital (2017)	**1,31**	**0,25**	**3,87**	**1,17**	**1,68**

Table 9: Credit default spread derivation based on credit rating and interest coverage ratio for more mature companies

If interest coverage ratio is:

greater than	Smaller or equal to	Rating is	Spread is
-100000	0,499999	D2/D	12,00%
0,5	0,799999	Caa/CCC	10,00%
0,8	1,249999	Ca2/CC	8,00%
1,25	1,499999	C2/C	7,00%
1,5	1,999999	B3/B-	6,00%
2	2,499999	B2/B	5,00%
2,5	2,999999	B1/B+	4,00%
3	3,499999	Ba2/BB	3,25%
3,5	3,9999999	Ba1/BB+	2,75%
4	4,499999	Baa2/BBB	1,75%
4,5	5,999999	A3/A-	1,50%
6	7,499999	A2/A	1,25%
7,5	9,499999	A1/A+	1,10%
9,5	12,499999	Aa2/AA	0,90%
12,5	100000	Aaa/AAA	0,75%

Table 10: Market values of D/E ratios of peer companies in all segments

Automotive	MV D/E
BMW	1,64
VW	1,93
AUDI	0,17
Geely	0,01
BYD	0,37
BAIC	0,49
GM	1,72
Renault	2,06
Daimler	1,38
Volvo	0,41
Toyota	0,92
Average	1,01
Median	0,92

Internet Media	MV D/E l
Alphabet	0,01
BAIDU	0,08
Alibaba	0,05
Facebook	0,00
Average	0,03
Median	**0,03**

Energy Storage	MV D/E
AES	2,79
ABB	0,13
LG Chem	0,11
Hitachi	0,40
Ameresco	0,50
Average	0,79
Median	**0,40**

Energy Generation	MV D/E
SunPower	1,36
Sunrun	1,68
Solaredge	0,00
FirstSolar	0,06
JASolar	2,58
Average	1,14
Median	**1,36**

Table 11: Market values of D/(D+E) ratios of peer companies in all segments

Automotive	MV D/E
BMW	0,62
VW	0,66
AUDI	0,14
Geely	0,01
BYD	0,27
BAIC	0,33
GM	0,63
Renault	0,67
Daimler	0,58
Volvo	0,29
Toyota	0,48
Average	0,43
Median	**0,48**

Internet Media	MV D/E l
Alphabet	0,01
BAIDU	0,08
Alibaba	0,05
Facebook	0,00
Average	0,03
Median	**0,03**

Energy Storage	MV D/E
AES	0,74
ABB	0,11
LG Chem	0,10
Hitachi	0,29
Ameresco	0,34
Average	0,31
Median	**0,29**

Energy Generation	MV D/E
SunPower	1,36
Sunrun	1,68
Solaredge	0,00
FirstSolar	0,06
JASolar	2,58
Average	1,14
Median	**1,36**