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HANDELSHØJSKOLEN

Valuation of Tesla Motors

Master Thesis by Andreas Roland Petersen

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Abstract

The objective of this paper is to examine if the increase in the stock price of Tesla Motors (Tesla) is justified in the fundamentals of the company. The various ways of valuating a company is explored with a focus on the discounted cash flow and economic value added method. The application of these two valuation methods require estimation of cost of capital. There are various components to account for when calculating cost of capital and therefore a review of the subject is deemed relevant. The paper is divided into five parts. The first part is an introduction to the valuation theories and a reasoning for choosing DCF and EVA. The second part is a thorough walkthrough of the discount rate and a calculation of it. The third part is an analysis of the industry to estimate future growth and a financial analysis to understand the fundamentals of Tesla Motors. Subsequently, this leads to the valuation of Tesla Motors, and the findings of the valuation are evaluated and discusses in the fifth part of the paper.

In the first part of the paper, valuation approaches are examined as well as the methodology behind them. From this examination the discounted cash flow and economic value added method are considered appropriate. The second part of the paper follows up on the valuation methods and focuses on the determinants of the correct cost of capital. This part finds that the cost of capital for Tesla is 5.84% which is lower than the average of the industry of 6.22% (Stern Business School, 2016). The third part evaluates the potential future growth for Tesla, and find it to be promising. The future launch of medium segmented cars and a reduction in production cost with the Gigafactory provides Tesla with the opportunity to entrench itself in the automotive industry. With a historical compounded average growth rate of 103% for the last five years it is estimated that Tesla will grow to a significant size within the next decade. Based on these estimates, a valuation is carried out, and it is estimated that the valuation of Tesla is 0.82% over market price when discounted cash flow method is used and valued over market price with ~2.55% when economic value added model is used. The last part of the paper tests the sensitivity of the valuation for changes in essential components the discount rate. It is demonstrated that the models are very sensible to assumptions of the discount rate.

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1 Introduction

For many years, creditors and debtors have been using discounted cash flow models for calculating value of loans. After the stock crash in 1929, Irving Fisher and John Burr William's in their books *The Theory of Interest* (Irving, 1930) and *The Theory of Investment Value* (Edwards & Williams, 1939) formulated what is today known as *Discounted Cash Flow Model*. The model is widely used for valuation of companies. Since the creation of the model, other valuation theories such as Economic Value Added and multiple valuation, to name a few have surfaced. The models are comprehensive tools to evaluate the value of a company. However, these are dependent on predictions of the future results and the predictions are subjected to assumptions made by the analyst/user of the model. The usefulness/precision of the models is therefore correlated with the correctness of the assumptions made by the analysts. Most of the valuation theories uses some kind of discount rate, which is used to compare cash flows over. In this paper there is a focus on the weighted average cost of capital as discount factor. As part of or the entire denominator in several of the valuation models, the determination of the discount factor is an important part of the valuation process. It is therefore interesting to look at how this factor is calculated and how sensitive it is to the assumptions used.

The purpose of this paper is to look at valuation methods with focus on the discounted cash flow model. For this application the paper will use Tesla Motors as case. The paper will elaborate on the general application of discounted cash flow, the pitfalls of using this method and the usefulness of it.

The motivation for the paper stems from an interest in company valuation, an interest that has been nurtured doing my semester in Australia and my interest in innovative technology. My interest is further backed up by the increasing focus on climate change and the shift in the energy sector towards renewable energy and renewable technologies. The book *Clean Disruption* by Tony Seba, introduced the notion that electric vehicles will dominate the car industry within the foreseeable future (Seba, 2014). With their mission to provide the world with zero emission cars Tesla Motors lives up to this. Tesla is a company that strives on the high-end market and the increasing development in sustainable energy primarily lead by increasing in computer power.

Without taking any sides in the debate, I am curious as to whether the rocketing stock price of Tesla increasing from 34 USD in January 2013 to 230 USD as of August 1st 2016 is warranted in the fundamentals of the company.

1.1 Problem statement

The paper sets out to explore the share price of Tesla Motors with the known valuation theory *Discounted Cash flow* and *Economic Value Added*. The weighted average cost of capital (WACC) is a key component in the models and has according to *The WACC Fallacy* a large impact on the valuation (Krüger et al. 2015). This paper will look at the components of the WACC, with emphasize on the price of equity calculated by the capital asset pricing model as developed by William Sharpe (1964) and John Lintner (1965).

The paper will try to answer the following questions:

- *Is Tesla's stock price warranted in the fundamentals of the company?*
- *What are the consequences of calculating the wrong cost of capital?*
- *How sensitive is the discounted cash flow model and economic value added model to the discount factor inputs?*

This will be accomplished by answering the following sub questions:

- *What is the cost of capital for Tesla Motors?*
- *What is the impact on the discount rate if the equity risk premium, beta or risk free rate is estimated incorrect?*
- *What is the impact on the predicted share price if the equity risk premium or the beta is wrongly estimated?*
- *What is the expected revenue growth rate for Tesla Motors?*
- *What is the impact of estimating the wrong revenue growth?*
- *How has the financial performance of Tesla been since its IPO?*
- *What is the forecasted free cash flow?*

To answer the problem statement and sub questions, an analysis of Tesla will be performed. The theory concerning calculation of WACC and using the discounted cash flow will be reviewed, and a sensitivity analysis will be performed on the component, with regards to its effect on the discount rate and on the share price. Lastly the paper will look at the current share price of Tesla and compared it to value as estimated by the author.

1.2 Delimitations

This sections defines the boundaries of the assignment and tries to limit the scope of the paper.

Tesla Motors have operations all over the world, as of their latest annual report (2015), they have defined their own revenue streams stemming from four different segments: North America, Norway, China and "Other." Throughout the financial and strategic analysis, these segments will be applied if possible.

Tesla Motors has made an offer on SolarCity, which SolarCity has until September 14th to accept/decline. SolarCity is a solar energy provider, and a comprehensive analysis of their business segment is beyond the scope of this project. For the scope of this project, it will then be assumed that Tesla is paying fair value for SolarCity, and therefore SolarCity is not incorporated for in Tesla's revenue stream.

The information available and used in this paper is limited to publicly available information. Financial information up until the newest quarter report which account up till the 30th June 2016 will be used. As the quarter report was in hand August 5th 2016, the date will be used as share price benchmark.

Through the paper, the follow companies will be used as peer groups as basis of comparison: Bayerische Motoren Werke AG (BMW), Audi AG (Audi), Ford Motor Company (Ford) and General Motors Company (GM). The justification for these companies will be provided in the Strategy Section.

Usually when WACC is used in discounted cash flow models, a constant WACC is used over time. The problem with this is that (usually) the capital structure changes over the years. As will be shown in the WACC analysis, the cost of debt and the cost of equity is not the same. Therefore, a change in WACC over the forecasting period result in a different value than if a constant WACC was applied. However, in this paper the WACC is considered to be constant throughout the valuation period.

1.3 The process

In order to answer the problem statement, there is need for several steps. Firstly, the theory regarding valuation theories and discount rate will be review and an appropriate valuation method will be selected. From the understanding of this theory, the inputs necessary to perform the valuation will be collected. This data collection will focus on the financial statements of Tesla Motors, and their future strategy. To forecast the future cash flows and revenues, a strategic analysis will be provided and the results will be applied. As the scope of this paper is to examine if the growth in Tesla Motor's stock is warranted in the fundamentals, a valuation will be performed. Further to investigate the impact the discount rate has on the share price, a sensitivity analyses will be performed. Amongst other things the paper aims to provide the reader with a theoretical understanding of the importance on selecting the correct discount rate. Further it will provide the reader with an understanding of the sensitivity of the components in the discount rate.

2 Valuation theory

This section sets out to introduce the reader for some of the different kind of valuation processes there is. As the problem statement is focused around the discounted cash flow model and the economic value added model, the relative valuation models will be introduced but not carried out. Through the chapter, the forces and short comings of the different theories will be explained.

The valuation tools available today includes absolute value models, liquidation models, and relative valuations. All these methods will be explained in the valuation section. However, as the scope of this paper is to examine the valuation method discounted cash flow and economic value added, focus will be put on absolute value models. For a valuation to be accurate, there are four categories the theory must account for. These categories in random order are: realistic assumptions, usability, understandable results and precision (unbiased results) (Petersen & Plenborg, 2012). These categories will be evaluated and compared to the models.

The discounted cash flow method will be thoroughly discussed, and compared to the economic value added. As the weighted average cost of capital is applied to all the models, the calculation of this will be thoroughly discussed in its own chapter.

2.1 Valuations types

There are several different ways and methods for valuating companies. These methods all have merits in different scenarios. The following section will introduce the different methods and argue for the method implemented in this paper.

There are five different types of valuations: Book value, breakup value, liquidation value, fundamental value and market value (Petitt & Ferris, 2013).

- Book value
    - The value from the balance sheet, that is the company's net worth, calculated by: Total assets – total liabilities.
- Break – up value
    - The break – up value is the value that can be achieved if the company is split up into saleable units and then sold off separately. This is usually relevant for large companies that composes of many different individual business units, divisions or segments.

- Liquidation value
    - If the company is to be liquidated in a distress sale. The value is usually lower than the book value, because it is different components is sold quickly and therefore at a discount.
- Fundamental value (intrinsic value)
    - The goal with this approach is to find the unbiased, and real value, that is the value you get if you apply the correct cash flow and the correct discounting rate (Damodaran, 2002). The values rely on the future after tax cash flows of the company, discounted to present value with a factor that takes into account the risk of the business. As both EVA and DCF falls into this category, the emphasize within this chapter will be on this type of valuation. The relative valuation method falls into this category as the fundamental values are compared to peers.
- Market value
    - This value is equal to the value established in a marketplace, such as a security market. An example of this could be the market value of equity (market capitalization) which is equal to share price multiplied by number of shares.

This paper focuses on the fundamental valuation method. While the above mention valuation methods all have their merits, for the scope of this paper, the interesting part is the fundamental valuation.

2.2 Value of equity or value of the entire firm

When the valuation method has been selected, there are two types of targets of the valuation, either the value of equity of the firm or the value of the entire firm.

- Equity – Only values the equity stake in the business
    - In this method, cash flow is considered from assets but only after debt and reinvestment – the discount rate is only for the cost of equity.
- Firm – Values the entire business, that include other claimholders (Damodaran, 2002).
    - Cash flows is considered before debt but after reinvestment. Discount rate is both equity and debt in proportion to their use (WACC).

Tesla has an equity/debt ratio of around 9:1, so it would be erroneous to value equity only. To understand the full scope of the enterprise, valuation of the firm is chosen. For this purpose, the discount rate will be calculated.

2.3 Tesla Motors - A cyclical firm

A cyclical firm is defined by a company or industry that has cyclicality in revenue and earnings. Cyclical companies tend to suffer in times of recession and prosper in periods of economic growth. Precisely where in the cycle they tend to have peak earnings depends on the industry. Tesla, being a sole automotive company (before the acquisition of SolarCity) fits the criteria of a cyclical firm. Before Tesla introduced their "Model 3" car which is to available at the end of 2017 (Tesla Motors, 2016d), their product is a premium/luxury commodity. Being a producer of a luxury commodity, they are less prone to cyclical ups and downs. When they launch their model 3 car at the end of 2017, they move towards being a more cyclical company.

It can be a difficult job to valuate earnings and cash flows of cyclical firms because of their close relationship to the economy. To estimate the cash flow, thorough knowledge of the economy and future trends is necessary. While it is impossible to predict the future, some movements are more likely to happen than others are and therefore there is need for limitations in the valuation model. This effects the evaluation when estimating the future income of the firm. Because of uncertainty of the future, it is normal that valuations estimate future financial elements based on assumptions from the past or trends from the past. Section 6.4 will explain these limitations, and assumptions.

2.4 Relative valuation vs absolute valuation

While there are different types of valuations, there is only two types of valuation results and the following section will introduce the reader them. The aim with the section is to give the reader an understanding of them, and what they are used for.

2.4.1 Relative valuation

Relative valuation gives a price relative to the market or to another asset. The idea is to give a "quick and dirty" way to estimate the value of the company (Petitt & Ferris, 2013). The method uses multiples as tools for valuating. A multiple is a ratio between to financial variables. An example of a multiple could be price to earnings or price to book value. The multiples available is practically endless, however there are some multiples that reveals and tell more than others. When using a multiple one can compare the company to an industry average or industry peers. For instance, General Motors would be compared to Chrysler, or Ford. One of the inherent flaws in doing comparable multiple analysis is that one assumes the pricing of the peer company is correctly valued.

The relative valuation methods can be a quick way for an analyst to estimate whether a company is valued correctly or if there is a potential upside. However, as the scope of this paper is to examine the discount rate's impact on the valuation of DCF and EVA models, this type of valuation will not be carried out.

2.4.2 Absolute valuation methods

The absolute valuation methods give, instead of a relative value an absolute value of the firm, the equity or whatever assets is valuated. There are different variations of absolute valuation methods, the ones that will be introduced in this paper are the following:

- Discounted Cash Flow Model
    - Free Cash Flow to the Firm
    - Free Cash Flow to Equity
- The Extended Value Driver Formula
- Economic Value Added

There are other models for direct valuation which will not be look at within this paper:

- Non Discounted Cash Flow Models
    - Real option analysis
    - Economic income models (Residual income models)

2.5 Terminology and definitions

Before introducing the different models, a section will be dedicated to explaining the terminologies.

There are different ways to calculate or determine the cash flow. How you determine it plays a large part of the end valuation (Mian & Velez-Pareja, 2007).

The free cash flow (FCF) is arguably the most used term within valuation. The free cash flow is the amount of cash that is back after operations and reinvestments. Throughout this paper the following definition will be used:

Free cash flow = cash flow from operations + interest expense * (1- effective tax rate) – net reinvestment (Petitt & Ferris, 2013).

As seen in the equation the free cash flow represents the residual amount of cash after the necessary operations and capital investments but before potential distribution to the providers of capital. Free Cash Flow also takes the tax shield into account.

The equity cash flow (ECF) includes disbursement of interest and principal debt. The debt cash flows are deducted from the total cash flows, and as a discount rate the cost of equity is used instead of the weighted average cost of capital.

Cash flow to debt holders (CFD) this is the proceeds and interest that goes to the debt holders on the outstanding debt.

Capital cash flow (CCF) is the cash flow available to both equity and debt holders. This cash flow only incorporates the tax benefits of deductible interest. As discount rate, the before-tax WACC is used. This is the sum of the CFD and ECF.

When calculating the present value, the two important factors are the discount rate and the cash flow. It is therefore important to use the correct cash flow and the correct discount rate.

2.6 Discount rate

A discount rate is the return in percentage the investor requires for his investment. The following definition is given by (Larrabee, David T. & Voss, 2012) "*A discount rate is defined as the rate of return an investor would require to be induced to invest in the cash-flow stream being discounted*". The external factors that affect the discount rate is named below. These factors are captured in the components within CAPM (Sharpe, 1964) with beta, equity risk premium and risk free rate.

- General economic conditions
- Yields available on alternative investment
- Industry conditions and outlook.

During the analysis of the discount rate, these factors will be considered, and an estimate of the discount rate will be produced.

The weighted average cost of capital (WACC) is used as the discount rate to find the present value of the cash flows. The WACC is the weighted average of the overall capital structure of the firm.

That is the cost of equity (K_E) and the cost of debt (K_D). The cost of equity is often calculated by using capital asset pricing model (Sharpe, 1964) and the cost of debt is the effective rate the company pays on its debt. The cost of capital can be calculated either before or after tax. Because interest expense is deductible in most countries, the after tax rate is usually applied. The after tax weighted average cost of capital is equal to the weight of equity * the cost of equity + the weight of debt * the cost of debt * the deductible tax shield. It is assumed that the $W_E + W_D = 1$.

$$WACC_{AT} = W_E * K_E + W_D * K_D(1 - T_C)$$

Before-tax WACC

$$WACC_{BT} = W_E * K_E + W_D * K_D$$

The weighted average cost of capital will be thoroughly discussed in its own chapter as it plays a key part in all of the valuation method mentioned and a part of the research question this paper sets out to answer.

2.7 Valuation models

This chapter sets out to introduce the components of the two valuation models, discounted cash flow and economic value added.

2.7.1 Discounted cash flow model

The term Discounted Cash Flow Model, is an umbrella which fits more than one model, and the most commonly used is *Free Cash Flow to the Firm* model. Free Cash Flow to Firm, is an extrapolation of the *Cash Flow to Firm* which is explained below.

The model works on the premise that the value of the company is equal to that of the present value of all future cash flows. The idea with the model is to use compounded interest rate to discount the cash flows (Damodaran, 2002).

The original formula:

$$\text{Value} = \frac{CF_1}{(1+i)^1} + \frac{CF_2}{(1+i)^2} + \ldots + \frac{CF_\infty}{(1+i)^\infty} = \sum_{n=i}^{\infty} \frac{CF_n}{(1+i)^n}$$

Where

CF = cash flow

i = discount rate

n = time periods from one to infinity

This formula above, assumes a continuing cash flow in perpetuity. This is not impossible, but very few companies live “forever” and it is rather impractical to assume that. For that reason, the model is expanded to include a terminal value.

$$\text{Value} = \sum_{n=i}^{t} \frac{CF_n}{(1+i)^n} + \frac{TV_t}{(1+i)^t}$$

n = time periods, time = 1 to t

TV = terminal value.

The formula can be redesigned to include a terminal value, that is the value of the firm where it to be valuated at a given time. If the cash flows go to period t, the terminal value is the value if the company where to be valuated at time t. When calculating the future cash flow, it is optimal to calculate each year individually. However, since this is very difficult to estimate the precise revenue growth for each year in the future, assumptions are made about the phases. The conclusion of the strategy section illustrates the need for three phases, the growth phase, the declining growth and the steady state phase. The terminal value is calculated as the value just before entering the steady stage phase. These phases will fit that of Tesla Motors future revenue.

When calculating the cash flow, it is important to specify which *type* of cash flow is calculated, whether it is *free cash flow* or simply the cash flow. Since Tesla Motors is still growing reinvesting is necessary for them, and a lot of their revenue goes to reinvestment, see figure 6-2. For this reason, the cash flow after reinvestment is used. The reason for this is simply using the cash flow generated is not taking into account the capital expenditures that is required to stay in business.

The cash flow model can be restructured into free cash flow.

$$\text{Value} = \sum_{n=i}^{t} \frac{FCF_n}{WACC^n} + \frac{TV_t}{WACC^t}$$

Where FCF is free cash flow to the firm.

The accuracy of the discounted cash flow model dependent of a correct estimation of future cash flows. A younger company like Tesla Motors, having a negative operating cash flow as seen from figure 5-4 in the financial section, is common. As a result of this, a large part if not the entire part of the total value of the company lies in the terminal. This was evident in the valuation made by Deutche Bank (Bank, Lache, Nolan, & Levin, 2016) where 95% of Tesla's value was captured in the terminal value. This is the case with the valuation of Tesla performed in this paper, where the terminal value accounts for 144 % of company value, see figure 8-1,8-2,8-3 in the valuation chapter. As such the valuation is very sensible to impacts on the discount rate, which is compounded when discounting the terminal value.

2.7.2 Economic value added

The model called Economic Value Added (EVA), is another way to valuate a company. The premise of the model is that it analysis the key component of firm value. The basic principle of EVA analysis is that the key driver of firm value is the spread between the return on existing investments and the cost of capital of the investments. Compared to DCF models it accounts for the initial capital cost, whereas the DCF calculates the future cash flows (Adserà et al., 2003). The Economic Value Added model calculates the economical profit. The economical profit is defined as Total revenues – cost of capital. The models valuate the difference between revenue and economical cost (book cost + opportunity cost) (Kislingerov, 2000). The formula of EVA is as follows:

$EVA_t = NOPAT_t - C_t * WACC_t$.

Where NOPAT is Net Operating Profit After Tax

C_t is long term capital.

This formula can be rewritten to account for not just the EVA, but the value of the company:

$$\text{Value of a company} = C_t + \sum_{t=1}^{n} \frac{EVA_t}{(1+WACC_t)^t} + \frac{\frac{EVA_n}{WACC_n}}{(1+WACC_n)^n}$$

Where n is the length of the forecasting period.

The EVA model and DCF model should provide the same firm valuation, if they are both applied using correct assumptions (Adserà et al., 2003). That is, if the forecasted revenues or the market analysis is incorrect, the models will not provide the same results.

2.8 Terminal value

Since growth companies can't keep up their high growth rates indefinitely it can be difficult to calculate the present value with discounted cash flows. If the momentarily growth rate is extrapolated into perpetuity the result will be an overpriced company. The terminal value is used as a point where the growth of the company has matured. For growth companies a lot of the value of the company is captured in the terminal value. Consequently, the terminal value will play a much more defining part in the valuation in a growth.

The terminal value can be calculated in the follow three ways (Damodaran, 2002).

2.8.1 The liquidation value

This method assumes that the firm will cease to exist at some point. At that point it will sell all of its assets to the highest price possible. The liquidation value is the value of all the assets at this given point in time. There are two different ways to calculate the liquidation value:

Book value of assets – adjusted for inflation: This method does not account for the future earning potentials of all the assets because it only takes book value into account. The formula for deriving this value is:

$$Expected\ liquidation\ value = \ Book\ value\ of\ assets_{term\ year} * (1 + Inflation\ rate)^{average\ life\ of\ assets}$$

Another way to calculate the value is by estimating the earnings power of the assets. It is important to remember to deduct the debt from the equation because a buyer would not buy this.

2.8.2 The exit multiple method

The model calculates the value an acquirer could reasonably expect to pay if the target is sold at the end the forecasting period. The exit value is computed by using a variety of multiples, as mentioned in the introduction to valuation there are various different ratios for this. The price is then discounted back to achieve a present value. The problem with using this model is that you are combining a relative valuation method with a discounted cash flow method which is an absolute valuation.

2.8.3 The perpetuity growth model (stable growth model)

This model assume that the company's cash flow will continue to grow at a constant rate in perpetuity. The point is to extrapolate the cash flows into the future by using a constant growth rate. This can be done either by using the existing growth of the firm or by choosing your own rate. It is however rare that a very high growth rate as seen in growth companies can be maintained and therefore do the analyst tend to pick a rate that is more in line with the long-term inflation rate plus 1 – 2 percentage. The continuing value is calculated as follows:

$$CV_t = \frac{FCF_{t+1}}{WACC\text{-}g} = \frac{FCF_t * (1+g)}{WACC\text{-}g}$$

The perpetuity growth model is the most appropriate to use for a company that is in the same development phase as Tesla. And it will therefore be used to calculate the terminal value of Tesla Motors.

2.8.4 The extended value driver formula

The perpetuity model introduced above in the text is not the only model which calculates discounted cash flow with an infinite time horizon. From Jennergrens (Jennergren, 2012) study of the application of perpetuity model, he discovered that there were some situations in which the formula did not capture the correct value, namely when the cash operating expense as a fraction of revenue is different between growth projects and existing operations.

A team from McKinsey have developed a formula which is called " *Value driver formula"* (Jennergren, 2012). The formula is another way of determining value for infinite cash flows. The article set out to explain under which circumstances the perpetuity model or the value driver formula is applicable. The article divides the valuation formula up in to two groups, the first group is existing operations and which is operations that are initiated at the start of the post-horizon period, and which value is not captured by the terminal value. The other group is the growing project which is initiated in the post-horizon period and is captured in the terminal value. The premise of the article is that the return on growth projects can be less than that of existing operations. The underlying assumption behind this is that as the company matures the market matures with it and abnormal returns are rarer to come by (Jennergren, 2012). The study shows that the perpetuity model and the value driver formula is equivalent under the assumption that the working capital requirement between existing operations and growth projects is different. The result of the research of Jennergren (Jennergren, 2012)is a much more elaborate formula for calculating firm value.

The extended value driver formula:

$$V_T = \frac{NOPLAT_{T+1}(1-\frac{i}{ROIC})}{WACC-i} + \frac{1}{WACC-C} * (\frac{PROJNOPLAT_{T+2}\left(1-\frac{i}{PROJRONIC}\right)}{WACC-i} - PROJINVCAP_{T+1}) ,$$

Where:

NOPLAT is Net Operating Profit Less Adjusted Tax after-tax sales revenue minus operating expense, minus accounting depreciation of PPE plus tax savings from tax-deducible depreciation.

ROIC is return on invested capital

i is the inflation

c is the nominal growth rate

PROJNOPLAT is project NOPLAT at the end of year T + 2 = $g(1+i)\left[S_{T+1}(1-\hat{z})(1-\tau)-\frac{1}{n}aF_c^n(1-\tau)\right]$

PROJINVCAP is project invested capital at the end of year T + 1 = $g(1+i)\left[aF_C^N\left(1-H_C^N\right)+\hat{w}S_{T+1}\right]$

PROJERONIC is project Return on Invest New Capital = $\frac{PROJNOPLAT_{T+2}}{PROJINVCAP_{T+1}}$

S_{T+1} is the forecasted sales revenue at the end of period T+1

aF_C^n is the gross PPE at the end of year T, and is calculated as:

a = the last expenditure of PPE cohort at the end of year T and

F_C^n is the backwards summation factor under the steady-state nominal growth rate c for PPE cohorts, that have not yet reached the end of their economic life n,

$$F_C^n = \sum_{V=0}^{n-1}\left(\frac{1}{1+c}\right)^v = \frac{1+c-(1+c)^{-(n-1)}}{c}$$

H_C^n is the steady-state accumulated depreciation as a fraction of nominal gross PPE, as earlier c is the nominal growth rate of the depreciation is linear over n years:

$$H_C^n = \frac{\sum_{v=0}^{n-1}\left[\left(\frac{1}{1+c}\right)^v * \frac{v}{n}\right]}{F_C^n} = \frac{1}{cn} - \frac{1}{(1+c)^n-1}$$

$\hat{z}$ is the cash operating expense for growth projects as a fraction of sales revenue

$\hat{w}$ is the working capital for growth project as a fraction of sales revenue.

While this method could be a good way to value the terminal value of a company. The simplicity of the perpetuity model leaves less assumptions to be made by the author and therefore increases the validity of the valuation.

2.9 Limitations

The above models are prone to the same limitation. They assume that elements such as risk and WACC and capital structure are constant. This is not always the case, and in order to get a more realistic view of these numbers one have to know more about the macro environment. Another problem with this valuation method is the determination of stable growth.

When the results of the estimation of a firm is higher than the market growth, the result is implicit saying that their return rate is higher than the required return rate for that period of time. If the market is efficient, it is not possible to maintain an above market return for a longer period. In competitive markets this is not possible and therefore will the excess return move towards the required return.

Damodaran (Damodaran, 2002) mentions three critical points/assumptions when determining the cash flow. While these will be expanded on later in the paper, the following is a quick summarizing of the critical points and how they are addressed.

- *When will the firm become a stable growth firm?*
    - In the conclusion to the growth chapter, the Tesla is estimated to enter stable growth in year 10 of the forecast period.
- *Cost of equity and capital.*
    - In the WACC section the cost of equity is calculated to 6.12% and the cost of capital is 5.86%.
- How to evaluate the transition from high growth to stable growth.
    - In the strategy section is it found that after the growth period of five years, Tesla will move toward the stable growth of the economy.

Factors to determine for how long a firm will be able to maintain high growth (Damodaran, 2002).

1. The size of the firm. Small firms have much less market share than larger firms and it is reasonable to expect that they will be able to maintain higher growth rates for longer periods of time. Furthermore, it is important to analyses the market potential, if the market keeps growing, the company can keep up the growth rate for a longer time.
2. Existing growth rate and excess returns. As seen in the strategy section, Tesla have had a CAGR of 103% over the last five years, a growth it not be able to continue. While the growth has been high, the returns hasn't been strong due to investment requirements.
3. Magnitude and sustainability of competitive advantages. This is a very important part of the analysis and it will be explored in the strategic analysis. The importance of competitors, barriers to enter the market plays a vital role in determining the length and sustainability of the future growth rate. This will be elaborated in the strategy section.

When applying these perspective to Tesla, it shows that Tesla has a large growth potential. As shown in figure 5-3 of peers in the strategy section, Tesla Motors' revenue is much smaller than that of its peers. They provide a fraction of the average revenue, with Tesla creating revenue at less than 5% of its peers. From this small market share, it is assumed that there is potential room for revenue growth.

2.10 Competitive advantage period

Competitive advantage period, as coined by Michael Mauboussin (Mauboussin & Johnson, 1997) is the period in which a company can be expected to earn excess returns. According to economic theory of the efficient market it is not possible in the long run to run a business whose earnings excess that of the market. If a company earns above market returns, it will consequently attract other competitors to the same market and thereby compete with the existing company. This will eventually drive the price to a point in which the marginal cost = marginal revenue or when the returns of the company only equal the required returns. Because the environment is a large part of the competitive advantage period, theories such as those developed by Michael Porter (1980) can be useful (Mauboussin & Johnson, 1997). Through the article of Mauboussin & Johnson (1997) drivers for CAP is explained to be:

- Company's current return on invest capital
    - Higher ROIC within industries are best positioned, this factor in e.g. economies of scale, entry barriers and management execution.

- Rate of industry change
    - It is difficult to maintain advantages in rapid changing sectors and therefore is it harder to keep high return rates in these sectors than in more steady sectors.
- Barriers to entry
    - The difficulty in which new players can enter the market. For instance, in the automotive industry, it takes a lot of capital to develop and start producing cars, where an app on the other side can be made with virtually no expense.

Tesla's return on invested capital is very low, and have been negative the past five years. This can be seen in figure 6-1 – Return on invested capital in the financial analysis section. However, Tesla is still in their high growth phase, so negative ROIC is to be expected. While the barriers to entry for new automotive companies is large, the risk of existing competitors to expand their production to contain electric vehicles is relatively simple for established manufactures. Based on the above it is estimated that Tesla Motors' competitive advantage period to be the present, however with the risk of other automakers turning their focus on electric vehicles, the period could be short.

2.11 Conclusion to the theory

All the different models have their merits, and using one particular is a challenging and difficult task for the analyst. In theory, the models should provide the same result, however as the analyst has to make assumptions as what input to give to the model, the result is rarely consistent.

2.11.1 Occam's razor

When selecting a theory to uses for valuation, the method of Occam's Razor become relevant. Occam's Razor is used as a heuristic technique to guide scientist through developing theoretical models (Gauch Jr., 2003). The method states that when choosing among different methods then the one with the least assumptions should be chosen (Gauch Jr., 2003). While the selection of valuation theory is not the same as discovering a new theory, the notion that the simpler theory should be selected is relevant in this case. The reason being, the less assumptions the analyst has to make, the less risk of error is there. This arguably reduces the risk of getting two of the four criteria mentioned in the introduction (*realistic assumptions, and precision)* wrong.

2.11.2 Economic value added and discounted cash flow

As mentioned in the introduction DCF and EVA should produce the same result, because EVA is mathematically derived from the DCF model. In the EVA model, there is a need for the starting capital base. This is crucial part of the valuation, but it is prone to biased since the term tries to summarize the capital adjustments over time to one parameter. For instance, if there is a very low start capital, it become “easier” to generate high value. This is in contrast to the DCF model which can show if the company return is less that the cost of capital.

To get a better understanding of the discount rate and valuation, both methods will be applied to valuate Tesla Motors.

3 Weighted average cost of capital

The following chapter will introduce the reader to the weighted average cost of capital. The purpose with the chapter is to give the theoretical arguments for the choice of discount rate. The theory will then be applied to Tesla, and the weighted average cost of capital will be calculated and used as discount rate. The rate will then be applied to the valuation, and with the results, a sensitivity analysis will be performed in the sensitivity chapter.

The Weighted Average Cost of Capital (WACC) is used as the discount rate to find the present value of future cash flows. The numeral value of WACC reflect the investors' expected return/compensation taking time and risk into account. As the name suggest the WACC is the weighted average of the overall capital structure of the firm. That is the cost of equity (K_E) and the cost of debt (K_D). The cost of equity is often calculated by using capital asset pricing model (Sharpe, 1964) and the cost of debt is the effective rate the company pays on its debt. The cost of capital can be either before or after tax. Because interest expense is deductible in most countries, after tax rate is usually used. The weighted average cost of capital is a representation of the expected return from all the company's securities (Mian & Velez-Pareja, 2007). The after tax weighted average cost of capital with tax shield is calculated as follows:

$$WACC_{AT} = W_E * K_E + W_D * K_D(1 - T_C)$$

Without the tax shield WACC is calculated as follows:

$$WACC_{BT} = W_E * K_E + W_D * K_D$$

3.1 Tax rate

When Modigliani and Miller (1958) introduced their theory on the irrelevance of capital structure, they assume that there are no taxes. The reality is that taxes are present, and the capital structure is not irrelevant. The firm can benefit from debt since interest rates can be deductible. This is known as a tax shield. Vélez-pareja (2016) argues in his article that the tax shield of a company which has no positive EBIT has the value 0. It is assumed that the corporate tax rate is constant throughout the valuation period. The formula implies that interest will be paid every year throughout the life of the project. It is assumed that the tax shields are always realized in the year in which they occur meaning that earnings before interest and taxes are greater than or equal to the expected interest charges and that the tax is paid the same year as accrued. Whereas this is not the case for Tesla, the accounting regulations of Tesla (PricewaterhouseCoopers, 2015), allows them to carry forward losses and therefore utilize the tax shield at a later date (Mian & Velez-Pareja, 2007).

Based on the reasoning above, the weighted average cost of capital with tax shield is applied in the valuation. The free cash flows which is required in the forecasting, are applied after deduction of tax. Therefore, there must be accounted for tax. As Tesla is not operating only in America, but in a lot of different countries with equal amount of different tax structures, the average tax rate of the world 23.63% is applied (KPMG). Since Tesla have yet to produce positive EBIT, and thereby paying tax, Tesla's effective tax rate is unknown. It is assumed that their effective tax rate will adjust to the average rate when (if) they produce profit and have used their tax-shield.

3.2 Return on equity

The expected return on equity, r_e is in the literature calculated by the capital asset pricing model (CAPM) (Sharpe, 1964). The expected return on equity is the required return on a security which is used to explain what the opportunity cost of investing in another portfolio.

The capital asset pricing model (CAPM) was first developed by (Sharpe, 1964) and (Litner, 1965). The model is widely used in finance and assumes that the cost of equity is a linear function of market risk. The cost of equity is often used as the investors' required return on a security, equal to the opportunity cost of investing in an alternative portfolio. Consensus within the literature points to the capital asset pricing model for calculating the opportunity cost. As with many theories there are limitations and assumptions to be made when using capital asset pricing model (Pratt & Grabowski, 2014). The model requires several inputs, and is calculating a single-period, the data however can be the sum of several periods.

$$E(R_i) = R_f + \beta * (RP_m)$$

$E(R_i)$ = expected return for an individual security
R_f = Rate of return available on a risk-free security
β = market beta
RP_m = Equity risk premium (ERP) for the market as whole.

The following sections will break down the components for the capital asset pricing model.

3.2.1 The risk free rate, r_f

The risk free rate is denominated as the return of a security that the market generally regards as free of the risk of default (Pratt & Grabowski, 2014). No security is of course completely free from risk, but the model assumes such a position is available. In developed and financial stable countries, the government is viewed as default free. For this reason, the long-term government bond rate has been used as the risk free rate. This stems from the government has the option to either raise taxes or print money. The risk free rate incorporates the expected inflation because the risk-free rate increases or decreases as inflation estimates change (Pratt & Grabowski, 2014). If the inflation increases the risk-free rate also increases and if it decreases the risk-free rate decreases. Studies performed (Mikherji, 2011) however concluded that the market risk and inflation only explains 13 % of variation in real treasury bill return, 20% in intermediate government bond return and 23% of long government bond return. This discrepancy is mainly because the unanticipated inflation affects the real return on securities with fixed cash flows. Since longer-term securities have fixed cash flows for longer periods than the short term securities the effect on these is larger than on the short term securities. It is concluded (Mikherji, 2011) that the best proxy for risk free rate is the American treasury bills.

When estimating the risk-free rate, it is important to take the period of the cash flow into account. That is, if the cash flow is only valued for three years in the future, the risk-free rate should reflect that. To be consistent, the time period for the risk-free rate should reflect the same considerations as the beta. The values are taken from June 30th, because Tesla's newest quarter report is dated there. The five –year treasury bill was as of June 30th 1.01 % (U.S Department of Treasury, 2016). Consequently, the five – years beta calculation is applied.

3.2.2 Systematic risk, β (beta)

The beta is known as the systematic risk. Systematic risk is known as un-diversifiable risk, and the risk affects the entire market. The risk cannot be mitigated and cannot be avoided through diversification. In the capital asset pricing model (Sharpe, 1964) beta is used with equity risk premium (ERP) and risk free rate to estimate the equity price. The beta is calculated using the following formula:

$$B_i = \frac{cov(R_i, R_m)}{Var(R_m)}$$

Where:

B_i is the expected beta of the stock of company *i*.
R_i is the return on stock *i*.
R_m market portfolio return.
$Cov(R_i,R_m)$ is the anticipated covariance in the excess return compared to risk free (R_i - R_f) on stock of company *i* and the excess return on market compared to risk free (R_m - R_f).
$Var(R_m)$ is the expected of excess return on the overall stock market.

The method to calculate beta is by regressing historically observed returns against market portfolio. The value of the beta tells how the stock move compared to the market index. If the value is zero, there is no correlation, and if it is one there is perfect correlation. With a value above one, the stock is more volatile than the market.

There several factors to take into account when estimating the beta: The choice of market index, the choice of return interval, post-regression beta adjustments and the time period. In the section about Tesla, it is explained that the majority of Tesla Motor is American investors. These factors will be analyzed in the following sections.

3.2.2.1 Choice of market index

As mentioned above one of the key point in calculating the beta is to evaluate the choice of market portfolio index. The most commonly used index for calculating beta is the S&P 500 for US companies. S&P 500 is used even though it is relatively small (only indexing 500 companies) but it has the advantage of being market weighted (Damodaran, 1999). Since Tesla Motors is listed on NASDAQ, beta's comparing Tesla to NASDAQ will be provided. (Bradford & Damodaran, 2014) argues that the correct beta for Tesla is the average of NASDAQ and S&P 500, because they are partly a technology company. However, when taking the Model 3 production into consideration, it is assumed that they in the future to a larger extent will be an auto manufacturer rather than an it-company. For that reason, will the beta for S&P 500 be applied.

As seen from the stock return of Tesla the volatility is larger than that of their peer's automotive manufactures. The return is looking more like that of young technology firms (Bradford & Damodaran, 2014). In their valuation of Tesla, Bradford & Damodaran suggest using a weighted average of the betas of both the technology and automobile sectors (Bradford & Damodaran, 2014).

As mentioned in the introduction, American investors hold the majority of Tesla's shares. According to Damodaran (2012), indices that include more securities and are market-weighted, yields better estimates, therefore the S&P 500 index is chosen.

3.2.2.2 Choice of time period

When choosing a time period for beta estimation, there is a trade of to be considered – more data points in the regression vs characteristics of the business. The more data point i.e. the longer period of time in the regression the less sensitive will the regression be. From figure 3 –1 Tesla Motor beta, it shows that the value provided with very short time period (2 day) is very high and do not provide an adequate representation of the general volatility of Tesla Motors.

By extending the regression time period, there is a risk that the company has changed its business model.

In the strategy section the business model of Tesla will be elaborated, for the sake of the beta calculation it is sufficient to know that the business model hasn't changed. Since the IPO Tesla haven't fundamentally changed its business model (the model S was first shown as a concept car in 2009), and to decrease the error margin on the regression a period of five years is used. Another reason for using five years is to have consistency between the forecasting years of growth and the years used as discounting factor for the growth phase. It is worth noting that if/when the Tesla Acquire SolarCity, their business model will change.

3.2.2.3 Choice of return interval

The choice of interval is like the choice of time period something that need to be considered. The shorter the interval is the larger data sample. With companies not traded that often, there is a risk of choosing a too short interval and therefore not having enough data points for the regression. Tesla is as of 29. June 2016 traded close to 5 m shares per day which is an average of trading ~57½ times per second (NASDAQ, 2016). This stand in contrast to the average trading on NASDAQ of ~9½ times per second (NASDAQ, 2016). These numbers are presumably inflated because of high frequency trading. Because of this relatively high trading frequency there is enough data point to pick the daily trading rate, and therefore more data points.

3.2.2.4 Beta calculations

When running the regression, it was apparent that Tesla hasn't been traded for long compared to the entire index. As mentioned earlier in the chapter Tesla went public June 29 2010. Historical trading data is therefore limited from that point and to the present. Tesla started out by being traded low when they became public listed at ~ 20 USD. From the first public day of trading and until august 5th 2016 they have experienced up's and down's. Within the latest year they have announced their new car Model 3, which was appreciated by the market.

Figure 3-1 - Tesla Motors beta compared to NASDAQ and S&P 500

Time period\Index		NASDAQ	S&P 500
2 days	Beta	-2.55	-2.84
	Adjusted Beta	-1.38	-1.58
1 week	Beta	0.12	0.80
	Adjusted Beta	0.41	0.87
1 Months	Beta	0.88	0.83
	Adjusted Beta	0.92	0.88
3 Months	Beta	0.67	0.74
	Adjusted Beta	0.78	0.82
6 Months	Beta	1.12	1.21
	Adjusted Beta	1.08	1.14
1 Years	Beta	1.17	1.22
	Adjusted Beta	1.12	1.15
3 Years	Beta	1.36	1.32
	Adjusted Beta	1.24	1.22
5 Years	Beta	0.85	**1.28**
	Adjusted Beta	0.90	**1.19**

Source: Yahoo Finance, compiled by author

As assumed from the theory the time frame of the beta calculation has a great impact on the beta results.

3.2.2.5 Adjusted beta

When doing beta regressions there are as mentioned above several factors to take into account. Therefore institutions such as Bloomberg for instance uses the following formula to push the beta toward 1 (Damodaran, 1999).

Adjusted Beta = Regression Beta (0.67) + 1.00 (0.33)

Firms beta tend to move towards one when they become older and more stable companies with a more diversified portfolio and more assets in place (Bradford & Damodaran, 2014).

As the production of car model 3 launches, Tesla will become more cyclical, as they move away from high end production to more main stream.

The adjustment with constant weight is not necessarily accurate as different companies approached the beta value of 1 with different velocities. This is affected by their diversification as firm that diversify more tend to approach the value of 1 faster than firm who is focusing on one business (Damodaran, 1999).

Tesla recently explored the possibility to diversify into solar energy is it reasonable to assume that they will try to keep this trend (Tesla Motors). On the basis of this, the application of adjusted beta is assumed to be the best suited.

3.2.3 Limitations

There can be several limitations when doing beta regressions.

Since the beta is regressed with regards to a specific index, the choice of index is paramount. As mentioned earlier S&P 500 is used in the calculations. Tesla is listed on NASDAQ, and NASDAQ could also be used as index for the regression. In some cases, especially in emerging markets there is a tendency for large companies to be predominant in the index.

When determining the right index, a large part of that is to determine who the marginal investor in the firm is. Because it is relevant to pick which index beta is regressed from, the choice of marginal investor is important. There is little use in regressing on the Brazilian index if the investor only invests in American stocks. The predominant part of shares in Tesla, is owned by American investors.

3.2.3.1 Tesla changes over time

One of the problems with beta regression is the evolution of the firm. The firms go through different stages of their business and their financial leverage. Tesla started out with producing a single high- end roadster and now they produce/aim for mass production with relatively cheap cars. Further they are exploring possibilities to go into solar plant business with their recent announcement of possible merger with SolarCity (Tesla Motors, 2016c). Beside the change in business structure, the financial structure of the firm also changes over time. In figure a-1 in the appendix is the historical development of its balance sheet. As seen from balance sheet, the debt of Tesla has been increasing since 2010. Both borrowing and paying of debt affect the beta along with payments of dividends and share buyback (Damodaran, 1999).

3.3 Alternative method to calculate beta

The accounting beta approach is when the accounting earnings instead of traded prices are used to calculate the relative risk parameters. The method regresses the change in earnings of the firm against the change in earnings of the market (Damodaran, 1999). The strength in using accounting beta is that if the markets are viewed too noisy or unavailable, this method can still be used.
There are three variables that determine the accounting beta (Damodaran, 1999)

3.3.1 Financial leverage

An increase in financial leverage will increase the equity beta while all other things remaining equal. The increased leverage will increase the debt and therefore the variance in profit in good vs bad economic cycles.
It is possible to calculate the beta of a leveraged firm by the following formula:

$$\beta_L = \beta_U \left(1 + (1 - t)\left(\frac{D}{E}\right)\right)$$

Where: β_L is the levered beta for equity in the firm, β_U is the unlevered beta of the firm (that is beta without debt), t is corporate tax, D/E is Debt/Equity Ratio.
Given the leveraged beta of 1.28 (using S&P 500) of Tesla the unlevered beta then becomes:

$$1.28 = \beta_U \left(1 + (1 - t)\left(\frac{D}{E}\right)\right).$$

The debt/equity ratio is based on the market value of the investment and not the book equity. The market value of equity and the market value of debt refer respectively to the equity and debt proportion of the market value (V) of the firm so that WE + WD = 100% debt as of June 30 2016 is USD 3,246bn and market value USD 28,464bn, the tax is ~24 %. This results in an unlevered beta value of 1.16.

3.3.2 Type of business

The type of business is important because the beta is calculated in relation to a market index. Therefore, if the business is cyclical or very sensitive to the market conditions the beta will reflect this. An example of cyclical companies could be construction of houses, production of materials or automobiles and these companies will experience higher betas than companies that are not so sensitive to business cycles, such as pharma or food processing companies. This stems from people's choices. While it is fairly easy for consumers to postpone the purchase of a new car or moving to a new house, rather than not buying food. Therefore, non-cyclical firms have a lower beta than cyclical firms.

3.3.3 Degree of operating leverage

The operating leverage shows how the relationship between the fixed cost and the total cost. If a firm has low operating leverage (i.e., low fixed cost relative to total cost) the firm would have a low variability in EBIT compared to a firm with high operating leverage. A higher variance in operating income will lead to a higher beta for the firm with high operating leverage (Damodaran, 1999). This is a factor were strategy plays in. If the firm decides to update plants, acquire new grounds or otherwise increase the fixed cost, the beta is affected.

$$\text{Degree of Operating Leverage}=\frac{\text{\% change in Operating Profit}}{\text{\% Change in Sales}}$$

Tesla had an operating leverage of 17.9[1]% in the financial year 2015.

While Tesla is a manufacturing company and needs lots of parts for its car production, the company is to integrate parts of the supply chain into their own business. Their newest project is their development of their Gigafactory in Nevada, where they amongst other things will produce lithium batteries which is the most expensive part in their car.

3.4 Limitations

There are three potential problems with accounting beta introduced above.

Firstly, firms have a tendency to even out the earnings so that they do not encounter huge spikes in tax expenses. This soothing relative to the underlying value of the firm gives the impression that there is less systematic risk. For risky firms this is seen by betas which is "biased down" and for more stable firms betas that is "biased up" (Bradford & Damodaran, 2014). The earnings of the firm can be affected by other factors than operation. This can give a misleading picture of the beta. As example could change in depreciation or inventory method or allocation of corporate expenses be mentioned.

Secondly, the frequency of reporting is low, and regressions will therefore have few data sets and the regression will hence have a low explanatory power.

[1] 4.7%/26.5%

Finally, the constant D/V ratio does not fit well with observed practice and/or may be difficult to maintain. Firms more typically manage issue amounts and repayment schedules, and would find it very difficult to maintain a constant debt ratio in a world of changing equity values (Vélez-Pareja & Tham, 2005).

Since Tesla is still a relatively new company, they are allocating much capital to research and development see figure 6-2. This results in a negative earnings stream which has been prevalent from the start of the company.

Because Tesla haven't had consistent earnings since 2009, it is difficult to calculate the accounting beta. With the newly announcement of acquisition of SolarCity who isn't delivering earnings either, the accounting beta is discarded.
Therefore, instead of using the accounting beta, the beta acquired from regressing stock returns will be used. A priori, it is to be expected that a technological/automotive company would be more volatile compared to the S&P 500 index, and therefore have a beta above one.

3.5 Equity risk premium

The equity risk premium is another component of the capital asset pricing model and represent the premium associated with equity and is it a key component of various other valuation methods. The premium reflects the intrinsic risk that is attached to the market. Think of the equity risk premium as the premium the risk adverse investor would demand for an average risk investment. If the premium increases the investors would deem the average investment more risky and will therefore pay a lower price for the same set expected cash flow (Bradford & Damodaran, 2014). The premium plays a vital part in both the cost of equity and the cost of capital. Risk is widely defined as *"variance in actual returns around an expected return"* (Damodaran, 2014, p. 6). The same definition is applied in this paper. When determining the equity risk premium, there are a few assumptions to be made, for instance if the analyst believe the market to be efficient, one assumes that the equity risk premium in the market is correct. On the other hand, if the assumption that markets are not valued correctly, over valued in the case of a bubble, the risk premium is too low (Damodaran, 2014). Conversely, if the assumptions are that the market is generally under-priced the equity risk premium is too high.

When determining the equity risk premium there are several things to consider:

- Investor risk preference

- Economical risk
    - The economic risk stems from a general concern about the overall economy. If the economy is stable, with stable/predicable inflation rates, interest rates and economic growth.
- Information
- Since the equity risk premium is a “symptom” of the inherent risk in the market, perfect information about the future earnings would eliminate the need for a premium.
- Statistical artefact
- Disaster Insurance
- Taxes
- Alternative Preference Structure
- Myopic Loss Aversion (behavioural finance)

The article *Equity Risk Premiums (ERP): Determinants , Estimation and Implications* list three different ways of determining the equity risk premium (Damodaran, 2014).

- Surveys
    - This method required surveys of investors, and managers to get a feeling of their expectations of the market and the future returns of equity. There is a certain element of uncertainty attached to this method as it requires the opinion of fund managers, investors etc. However, assuming they are doing their job, these assumptions is not based on thin air but on research. Further it can be said that their predictions of the market and their feelings are having a “self-fulfilling” element as their actions affect the market. The estimates are therefore biased by recent stock movement, and are reflecting the personal risk preference of the surveyed.
- Historical premiums
    - The historical premium is a method in which the actual returns on stock are compared to the risk free rate, the difference between these is then used as the historical risk premium.
    - The same limitations as when the beta is calculated have to be considered when calculating the historical premium. When it is possible the same data set, market index etc. will be used as when calculating the beta.
        - Different time periods for estimation

    - It is argued in the article (Damodaran, 2014) that while the historical data of 50 – 80 years may not incorporate the local volatility they provide a significantly lower standard deviation in the estimate.
- Choice of market (index)
    - When choosing the market index, the same index as used in the beta calculating.
- Choice of risk free rate.
    - There has to be continuity when calculating the risk free rate and when calculation the expected returns.

3.5.1 Arithmetic vs geometric return

The literature (Indro & Lee, 1997) defines two ways of calculating the return of a stock index or market, arithmetic and geometric.

3.5.1.1 Arithmetic

The arithmetic method is where the movement is added together and then divided at the end. For instance, if a stock has the following annual movement over the course of five years: +10%, + 20%, - 10% + 10%, - 20%. The arithmetic return would be: $\frac{(10\% + 20\% - 10\% + 10\% - 20\%)}{5} = 2\%$

3.5.1.2 Geometric

The method is to add 1 to the percent and the lift it to the power of 1/n. Using the same numbers would give the following result: $((1.1*1.2*0.9*1.1*0.8)^{1/5}) – 1 = 0,8\%$.

The difference between the two methods is that geometric calculates the losses on an ongoing basis where arithmetic does not. The arithmetic average does not take into account the previous years and treat them as separate entries, whereas the geometric compute the compounded return.

There are reasons for using both the geometric and the arithmetic values. Arguments for the geometric is that the stock returns are often correlated and according to research done by (Fama & French, 1992) there is a negative serial correlation in stock returns over time. The geometric method incorporates this to some extent. They found the five-year serial correlation to be strongly negative. The arithmetic method assumes there is no correlation, and it therefore tend to overstate the equity premium. However, if the calculation of the premium is over a short period of time Damodaran find the arithmetic it is the best and most unbiased (Damodaran, 2014).

Indro and Lee compared the geometric and arithmetic premiums in their article from 1997(Indro & Lee, 1997), and argues that both methods have its flaws and therefore propose a weighted average return method. This method should weight the geometric premiums at an increasing rate towards the time horizon (Indro & Lee, 1997).

The historical premiums are very dependent on the amount of data collected. When using a longer period of data, the estimation suffers from a smaller standard deviation. According to *Equity Risk Premiums* (Damodaran, 2014), the standard deviation in Equity Risk Premium varies from 8.94 % when using data for 5 years down to 2.23% when using data for 80 years. This is a very strong case for using data for a longer period as the standard deviation of 8.94%, 6,32% and 4% in 5, 10 and 25 years' historical data respectively, is likely to equal out the calculated ERP. (Damodaran, 2014) argues that the cost of using the smaller data sample is simply too much uncertainty to "pay" for a more updated premium. His research shows that there is a tendency for the historical equity risk premium to rise when the investors are less risk averse and markets are doing good. And will decline when markets are in trouble and the investors fear rise. This sounds counter-intuitive as one would assume the opposite, but when considering that the equity risk premium is the "price" for moving towards less safe investments it make sense that the price for is reversely correlated with the risk.

3.5.2 Equity risk premium value

As mentioned above there are many pitfalls and assumptions in calculating the ERP. Dimson, Marsh and Staunton (2002, 2008) have made a thorough research of current equity risk premiums, calculating it from 1900 – 2015. They recently updated their estimates with numbers form the last decade, allowing them with the help from Credit Suisse to produce the ERP values which will be applied in this paper. The results are shown in figure 3-2 below.

Figure 3-2 - Equity risk premium values

Country	Geometric mean	Arithmetic mean	Standard Error	Standard Deviation	Geometric mean	Arithmetic mean	Standard Error	Standard Deviation
U.S	5.50%	7.40%	1.80%	19.60%	4.30%	6.40%	1.90%	20.90%
Europe	3.40%	5.10%	1.80%	19.20%	3.00%	4.50%	1.50%	16.10%
World - ex U.S	3.50%	5.10%	1.70%	18.50%	2.80%	3.90%	1.40%	14.60%
World	4.20%	5.60%	1.60%	17.00%	3.20%	4.40%	1.40%	15.50%

Source: Credit Suisse's Research Institute, compiled by author

Having advantages and disadvantages in both the arithmetic and the geometric method, the geometric method is chosen. The reason for this stems from the logic that ERP is used to calculate the price of equity, which in turn is used to discount and therefore compound backwards. Therefore, it is inconsistent to use an arithmetic value that is not compounded. As mentioned earlier the marginal investor is considered to be American, and Tesla is based in U.S. Therefore, the U.S value will be applied. On the basis of the above reflections an Equity Risk Premium of The ERP value of 4.3% is used.

3.6 Calculation of CAPM

The equation is known as: $E(R_i)=R_f+\beta*(RP_m)$

From the previous sections the value of beta and ERP is 4.3%, the adjusted beta value is 1.19, and the risk free rate is 1.01%. This give a cost of equity of 6.12%.

Compared to the above research the cost of debt is relatively straightforward. It is the interest expense divided by debt. To get the most accurate cost of debt, the average debt from the latest annual report and the last quarter statements are used, see appendix figure a-1 and figure 5-4 in the strategy section. Tesla Motors' average interest expense in that period was USD 133.82 m. Its average Book Value of Debt (D) is USD 2981.19 m. That gives an interest rate of 136.88/2981.19. This give a cost of debt of 4.489%.

The weight of debt and equity is simply the equity with the total value of the firm. Market cap of Tesla is as of June 30th, 2016 USD 28,464.757 m. The debt is as of June 30th 3,247 m. The weight of equity is therefore $\frac{28{,}464}{28{,}464+3{,}247}$ = 89.76%, the weight of debt is $\frac{3{,}247}{28{,}464+3{,}247}$ = 10.24%

To conclude this section and to answer the following sub question:

- *What is the cost of capital for Tesla Motors?*

The calculation and assumptions for this chapter results in the following calculation:

The WACC without tax shield:

$WACC_{BT} = W_E * K_E + W_D * K_D$ = 89.76%*6.12%+10.24%*4.489% = 5.95%

When applying the tax shield, the WACC results in:

$WACC_{AT} = W_E * K_E + W_D * K_D$ = 89.76%*6.12%+10.24%*4.489% * (1 -23.64%)= 5.84%.

This is a bit lower than the industry average of automotive of 6.22% (Stern Business School, 2016). As will be seen in the sensitivity analysis, even a small variance in the WACC can result in a large change in the valuation.

4 Tesla Motors

The purpose of this section is to provide the reader a brief overview of Tesla as a company, their financial history and an introduction to their product line.

"We design, develop, manufacture and sell high-performance fully electric vehicles and energy storage products" (Tesla Motors, 2016e, p. 4).

Tesla Motors was founded in Palo Alto in California 2003 (Tesla Motors, 2016b). The engineers who started the company wanted to prove that electric cars could be better than gasoline-powered cars. Tesla took a turn when Elon Musk invested USD 30 m in the company and later became CEO. Tesla IPO'ed on NASDAQ on the 29.06.2010 under the name TSLA. As of 30.05.2016 their market cap is USD 31.537bn with 145.881 shares outstanding (Bloomberg: Tesla Motors,). Tesla's mission as describe on their homepage is: *"To accelerate the world's transition to sustainable transport"* (Tesla Motors, homepage). Their operating income (loss) was - USD 716m at the end of 2015, this was an increasing loss from USD -186m.

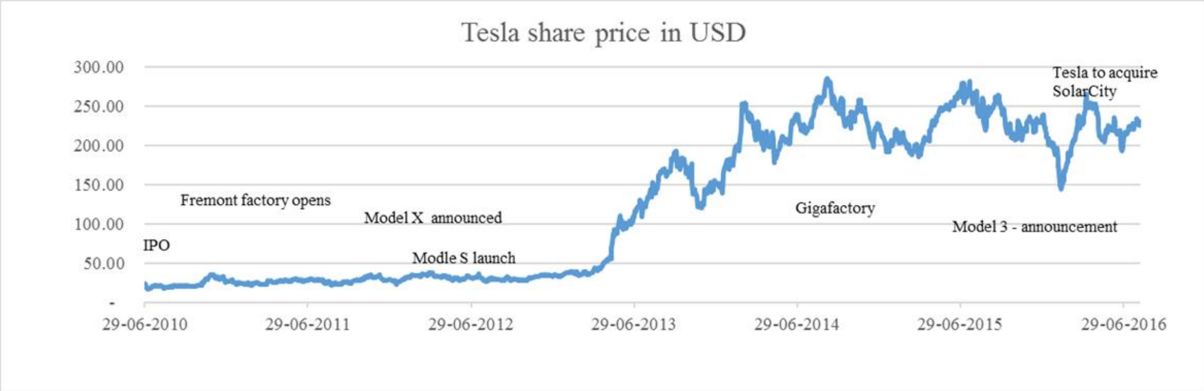
Tesla recently announced that they were going to sell 1.7 billion in new common shares to pay for machinery and engineering for their model 3 car production (Reuters). According to pecking order theory (Myers, 1984), this should be the last resort of financing, and is therefore not a promising sign for the financial health of Tesla. The pecking order theory is developed by Myers in his article The Capital Structure Puzzle and is the sequence in which a company cheapest raise capital (Myers, 1984). The theory states that only as a last result companies will tend to equity financings. This indicates that Tesla is in financial trouble. This will be explored in the financial statement analysis.

4.1 Tesla's share price development

Tesla is the first publicly listed pure electric vehicle manufacturer. The share price of Tesla has been volatile, but have experiences an increase from ~30 USD to ~220 USD as seen from figure 4-1. Tesla have had a compound annual stock price increase of ~ 44 %[2], from their IPO and six years forth.

[2] CAGR = (Price June 29 2016/IPO price)^(1/years(6))-1

Figure 4-1 - Tesla's share price, with events & announcements.



Source: NASDAQ, Yahoo Finance & Tesla Motors annual reports, compiled by author

4.2 Their products

The following section introduces the reader to the product line of Tesla Motors. The following quote gives an understanding of how they perceive their own products: *"Our (Tesla) core competencies are powertrain engineering, vehicle engineering, innovative manufacturing and energy storage"*(Tesla Motors, 2016e, p. 4).

4.2.1 Energy storage applications

In 2015, Tesla announced their next generation of energy storage products. The 7kWh and 10kWh rechargeable lithium-ion battery, Powerwall. Powerwall was introduced along with a 100kWh Power pack for commercial and industrial application (Tesla Motors, 2016e). Tesla have been selling home charging systems since 2013 and commercial systems since 2014.

Besides making cars, Tesla also invest in charging infrastructure in U.S and Europe to their cars their aim is that their customers can service, buy and charge their cars on Tesla owned utilities all over the world. Tesla believes that having control over the distribution provides an opportunity to improve the overall customer experience (Tesla Motors, 2016e).

4.2.2 Cars

Tesla Roadster was the first car the company launched in 2008. There are currently around 2400 Roadsters in 30 different countries (Tesla Motors, 2015). Four years later in 2012, Tesla launched their Model S. A car targeted for the premium sedan market. The Model S car was designed as a family car with room at storage while at the same time have the driven properties of a sports car. In 2013 the Model S was named Motor Trend's Car of the Year and achieved a 5-star safety rating from the U.S National Highway Traffic Safety Administration (Tesla Motors, 30.05.2016.). Tesla's Model S received the "best overall" title by *Consumer Reports* (Consumer Report, 2014)

4.2.2.1 Model S

Model S has been the face of Tesla cars and the only car besides the Roadster for several years. The car is a four-door sedan with space for five-adult. The car is fully electric and comes with a variety of equipment. It comes with different setups, and performances versions ranging from their "Ludicrous" speed upgrade which performs an astounding 0-100km/h in 2.8 seconds. To the "normal" version that resembles that of a fast sedan. The cars are benchmarked against the performance of the BMW 5-series, and thus is classified as a premium vehicle.

4.2.2.2 Model X

The Model X is Tesla's SUV car. It is still fully electric and comes in a variety of performance modification models. Tesla began delivering of the car in the third quarter of 2015.

4.2.2.3 Model 3

Tesla announced their new Model 3 on March 31 2016. The car's purpose is to be the a cheap yet fast and everyday use car for the normal consumer (Tesla Motors, 2016d). The car is targeted for the mass-market. In the first quarter update from 2016 Tesla announced that there have been an "overwhelming demand for Model 3" (Tesla Motors, 2017).Within the first week reservations were made for about $14 billion and about 325,000 reservations were made. The car is scheduled to be launched in 2017. The car was well received by the shareholders and public however Tesla struggles to produce the cars in time for your launch and the end of 2017 (Tesla Motors, 2016d).

4.2.3 Battery pack

Tesla design their own battery packs. They strive to upgrade their battery packs constantly as they realize that limited battery range is one of the things the consumers are cautious about. Tesla have made designed their battery so they permit "flexibility". This enables them to use their research in a global scale to reduce cost (Tesla Motors, 2016e). With their new Gigafactory in Nevada, Tesla aims to greatly reduce the cost of produced batteries. The batteries are a dominating factor in the end price for the car, so by reducing the battery cost, Tesla would be able to greatly reduce the cost of their cars (Tesla Motors, 2016e).

4.2.4 Factories

Tesla manufacture and assemble their cars at three different factories, their factories is located in Fremont and Lathrop both in California and in Tilburg in the Netherlands. Beside these factories are a Gigafactory in the works in Reno, Nevada.

4.3 Organizational structure

Tesla is a vertically integrated company who aims to control their own production and their own distribution of their products. As a part of their mission, Tesla have made an offer as of Juli 2016 to acquire SolarCity, the leading solar provider in America. If the acquisition goes through it will increase Tesla's product line and diverge their focus for from automotive and batteries. Since the acquisition have yet to be completed (SolarCity have until September 14th to accept other offers or decline), their product line will not be analysed.

4.3.1 Ownership structure

The ownership structure is interesting from an investment point of view. The reason for this is that when calculating the beta and ERP, it is important to know the marginal investor. Further it gives a perspective on who the owners are and could show difference priorities.

67 % of Tesla's shares are held by institutional owners, the top five owners own 54 % of the institutional shares. The five largest owners are Fidelity Management and Research (20%), Baillie Gifford (13%), Price T Rowe Associates (10.5%), Vanguard Group (4.8%), and Bank of Montreal (4.8%) (NASDAQ, 2016).

Elon Musk is Chairman of the Board, CEO, and Product Architect. He alone sits on a majority position with 20.92% of the shares as of June 2016 (NASDAQ, 2016).

4.4 Tesla as disruptive company

To conclude the introduction of Tesla, it is necessary to point out where Tesla deviate from the traditional automotive producer. Tesla is the only company that focuses exclusively on electric powertrain. Tesla departs from traditional model by exclusively focusing on electric powertrain technology and owning their stores (Tesla Motors, 2016e). However, as mentioned in the section about organizational structure, they are looking to buy a solar panel company, which will diversify their product portfolio. Tesla has several of the characteristics of a disruptive company as explained by Christiansen in his book *The Innovator's Dilemma* (Christiansen, 2003). He further argues that disruptive technologies often come from lower profit segments that industry leaders ignore this have been the case for some time now, albeit established automotive makers such as BMW and Audi already have or intent to launch electric vehicles. Tesla Motors have managed to create a new (at the beginning niche) market in which they are technological superior. By continuing to improve, they ultimately develop a technology that is more cost-efficient than the existing one (Christiansen, 2003).

4.4.1 Emission credits

Several states in United States have emission credits. These credits are economic incentives induced by the government to reduce pollution. Tesla, being a zero emission vehicle manufacturer is able to sell of their earned credits. The revenue of credit sales in 2015 was USD 168.7m, down from USD 194.4m in 2013 (Tesla Motors, 2016e). The likely reason they these revenues have diminish is because of the competition in the electric vehicle segments and other manufacturers adhering to these standards, it is likely that these revenues will phase out within the foreseeable future.

5 Strategy section

This sections sets out to give the reader an understanding of the automotive industry and together with the next chapter 8. Financial Statement Analysis to provide the information to answer the following question:

- *What is the expected revenue growth rate for Tesla Motors?*

5.1 Introduction to automotive industry

Ever since the industrial revolution and the automobile was introduced to the world and from when it became a consumer good has the industry experienced steady growth. Despite is newly entrance to the market Tesla has managed to forge a solid reputation in the industry among some group of consumers. It is pivotal to understand the dynamics of this global industry. An industry that employs almost five million people in America alone (Bureau of Labor Statistics, 2016). With a production of more than 90 million cars in 2015 alone, it is an enormous industry (The International Organization of Motor Vehicle Manufacturers).

This section aims to provide the reader an understanding of the industry in which Tesla compete, both on traditional automobiles and alternative fuel vehicles. Tesla anticipate that more than 50% of their revenue stream will come from countries outside of North America, and with this in mind, it is paramount to do an analysis of the global automotive industry (Tesla Motors, 2016e).

The automobile industry sales has grown steadily by an average of 3% yearly during the last 50 years (Mosquet, Russo, Wagner, Zablit, & Arora, 2014). By 2015 the global automobile car production exceeded 90 million. Especially during the last 15 years, the industry been has exposed to an explosive increase in the production. The increase over the last 15 years has been from 58 million produced cars to over 90 million in 2015 (Statista, 2016). This is an increase of 64%.

The increase is according to Statista expected to continue to around 100 million car produced in 2017 (Statista, 2016). In 2015 more than 22 million of the cars were commercial vehicles.

In comparison it is around twice the rate of global population growth in the same period. The primary increase in automotive sales has come from emerging markets mainly China who has seen automobile sales almost triple. Being the largest passenger car manufacturing country in the world, China is responsible for more than 22% of the world's passenger vehicle production (Statista, 2016).

Despite the global growth in the industry, the growth rates and sales are far from evenly distributed. Traditional automobile powerhouses such as Russia, Germany, Japan and Brazil have struggled to maintain their automobile sales.

Russia experienced extreme decrease in 2015, with sales almost halved since 2012. The sale market in Brazil has also decreased significantly with 30% since 2012 (Wilk, 2016).

5.2 Electric vehicle segment

In recent years a new type of car has surfaced, the electric vehicle. Even though the market share of this type of automobile is small they are enjoying high esteem from renewable and environmental aware users (Hensley, Knupfer, & Pinner, 2009).

Besides competing with the automotive industry Tesla Motors competes with the market for alternative fuel vehicles. That market consists of three different segments (Praem, 2014).

- Plug-in Hybrid Vehicles
  - A plug-in hybrid vehicle is powered by both a battery pack and internal combustion engine, it can therefore be fuelled/charged by both petroleum and electricity.
- Hybrid Electric Vehicle
  - A hybrid electric vehicle has a battery pack and an internal combustion engine, but can only be fuelled by petroleum. The combustion engine then generates electricity to the electric engine through regenerative braking.
- Electric Vehicles
  - Electric vehicles are fuelled solemnly by a battery pack that runs the electric engine. The battery pack must be charged at an electricity source. Tesla’s cars are all electric vehicles.

5.2.1 Batteries

The construction, development and possibilities with the battery packs are vast and interesting and though they are essential to the performance of the car they are not essential to this paper’s scope. Therefore, this section will only provide a brief overview of the battery pack.

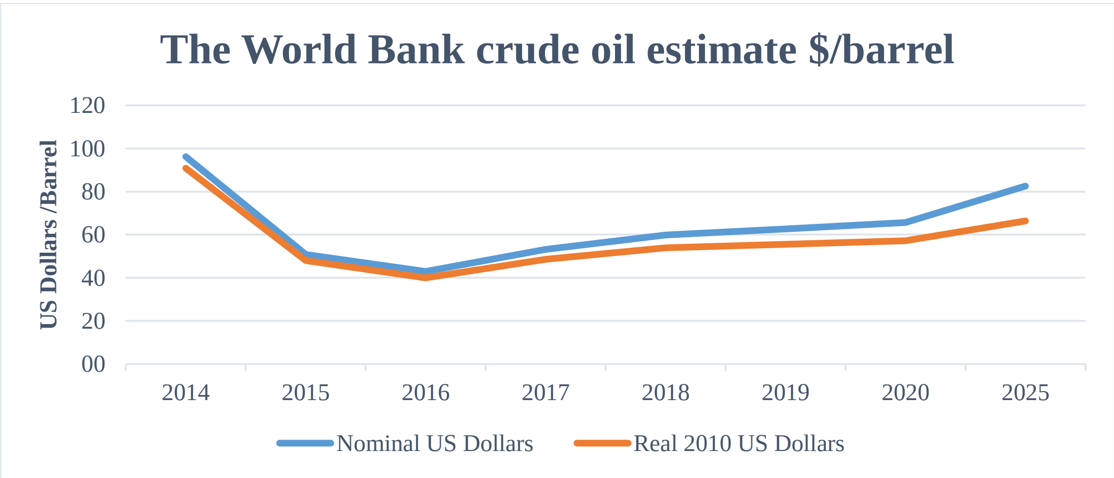
The battery pack is arguably the most important part of the electric vehicle, and at the same time one of the most challenging components to produce. The manufactures aims to deliver batteries which are safe, and resistant towards temperature fluctuation (Hensley et al., 2009). The cost of batteries is a large part of the overall cost of the vehicle and for that reason Tesla is working with their new Gigafactory to reduce the cost of lithium batteries (Tesla Motors, 2016e). The reduced battery cost through advances in technology and higher production scale, will everything else being equal, reduce the initial production cost of the electric vehicle. This development gives advantages to Tesla, and other electric vehicle manufactures as it allows them to be more competitive and sell their cars to a broader market. The reduced cost will allow Tesla to decrease the price of their vehicles. However, it can it be argued that other manufactures will benefit from the current research in improved lithium batteries.

5.3 Oil prices and GDP

The future growth of Tesla Motors is dependent on several factors. Since the automotive industry is cyclical, the entire industry and thereby Tesla are depended on the future economic growth. This dependency stems from Tesla starting to produce medium segment cars, which will fall in demand if the economy recesses. McKinsey & Company argues that the demand for electric cars is correlated with the price on gas, and therefore with the price of oil (Hensley et al., 2009). This stems from the argument that the economic incentive to use electricity as "fuel" instead of fossils is greater the higher the price of fossil fuel is (Hensley, Newman, & Rogers, 2012). Applying this logic, the future demand for Tesla is both correlated to the oil price and the health of the global economy.

The figure below shows the estimate oil price by The World Bank.

Figure 5-1 - Crude oil price



Source: The World Bank, compiled by author

If the estimates made by The World Bank (The World Bank, 2016), is accurate the price for a barrel of crude oil will increase by more than 50% within the next decade. This will drive gas prices up and will therefore increase the incentive to move towards electric vehicles. The GDP forecast is less consistent between IMF and The World Bank, and therefore more difficult to utilize. The International Monetary Fund estimates the future global real GDP growth to be 3.4 % in 2016 and 3.6% in 2017(IMF, 2016). Whereas The World Bank Estimates the future growth of World GDP to be 2.4%, 2.8% and 3.0% in 2016, 2017 and 2018 respectively (The World Bank Group, 2016). According to IMF the real GDP growth of the United States is estimated to be 2.6% both in 2016 and 2017. The World Bank estimates the real growth in the same period to be 1.9%, 2.2% and 2.1% (2018). From this information there is consensus amongst the two entities that the real GDP (cleared for inflation) will increase with approximately 2% a year.

5.4 Peers

To understand how Tesla is performing relative to their competitors it is important to compare them to a benchmark of peers.

To analyse Tesla's performance relative to its competitors, it is necessary to define a peer group which Tesla can be compared to. The peer group will be the referenced to throughout the financial and strategic analysis. There are several factors which need to be taken into account when selection the peer groups. According to Petersen & Plenborg (2012), they need to have similar operations and business models. Further, the size and geographical location is important. For the scope of this paper I have chosen both American and European automakers. The important notion is that while Tesla have grown a lot since its inception, it is still a minor player in the market. While Tesla have been a niche company only catering to the high premium segment, they are opening op for a new market with their Model 3. The peer group will therefore be operating both on the premium segment, and in the "medium" segment. Further the aim of the segment is to compare Tesla, which is only electric vehicles, and therefore the peer group must either only consist or at least have electric vehicles in their portfolio. Lastly, since Tesla is operating on the global market and aims to have more than 50% of their revenue coming from a global market in the future, all companies in the peer group are globally active.

The following companies are chosen for comparison with Tesla Motors.

- Bayerische Motoren Werke AG (BMW)
- Ford Motor Company (Ford)
- General Motors Company (GM).
- Audi AG (Audi)

In the selection of peers both Volkswagen and Porsche was considered. However, as Volkswagen owns a various other car manufacturer including Porsche and Audi, it was decided that the single business line of Audi fits the peer group of Tesla better. Further the scandal with diesel emission of Volkswagen has distorted the value and therefore is VW omitted from the comparison. While Porsche is also comparable to Tesla, the lack of public information regarding its revenues excluded it from this comparison.

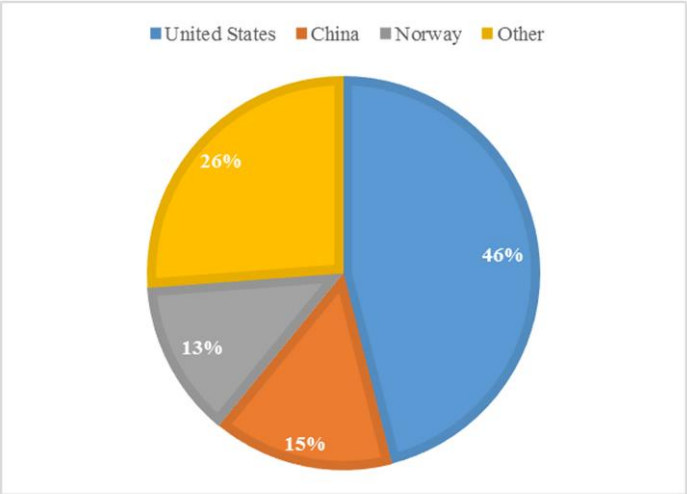
5.5 Strategic analyses

The following section set out to explain and evaluate the external factors that affect Tesla and possible will affect them in the future. The analysis will work out of a PEST(EL) framework. PEST stands for Political, Economic, Social and Technical (Jurevicius, 2013). In recent days there have been claims that the model did not cover newer topics, and the model has then been expanded to cover Ethics and Legal as well (Jurevicius, 2013). This analysis will set the foundation for the future prospects of Tesla. Instead of following the typical approach of listing each letter and applying it to the country, in order to have a smoother text, each country/region is analysed without break down. The PESTEL however contains some disadvantages limitations. The access to quality external information was in this paper restricted because of the cost. This limitation results in the analysis contains assumptions, assumptions that often form the basis for most of the data used, making any decision made based on such data subjective. Despite these theoretical shortcomings the PESTEL offer a powerful tool if combined with another framework such as the SWOT. The PESTEL is applied in order to ensure this paper identify the vital implications for Tesla's organization.

Before commencing the analysis, it is important to mention that Tesla, going forwards aim to have a significant portion of their revenue generated outside of America. *"... we expect our long-term sales outside of North America will be over half of our worldwide automotive revenue"*(Tesla Motors, 2016e, p. 24). Tesla disclosed their geographical segment in their annual report from 2014, but not in their report from 2015. It is assumed that this geographical allocation has not changed drastically since that.

For simplicity the revenue segments used by Tesla Motors in their annual report will be used in the analysis with PEST(EL) (Tesla Motors, 2015).

Figure 5-2 - Revenue distribution



Source: Tesla annual report 2014, compiled by author

5.5.1 United States

The U.S markets performed well in 2015, with a record high sale of just under 17.5 million vehicles. According to a report from Price Waterhouse Coopers this is an increase of 5.7 percent from 2014 (Wilk, 2016). The report further claims that the because the Federal Reserve raises overnight rates, the car sale is expected to drop throughout 2018. This stems from the assumption that it will become more expensive to lend money for a car purchase.

5.5.2 Other – Mexico, European Union, Emerging Nations

The Mexican auto sales hiked 19% from 2014, and totalled a sale of more than 1.3 million units. According to the report, the expected sales of automobile is to increase to above 1.5 million by 2021. (Wilk, 2016). Countries within The European Union are still struggling with recovering of local economies after the economic crisis in 2008. With countries such as Greece, Spain, Italy, Portugal and France still struggling with low growth or even recession. Even with these circumstances the new car registration rose by 9.3 percent year-on-year to 12.6 million units (Wilk, 2016)

Emerging markets have long been predicted to be the new driver or a large player in the car sales industry. However, 2015 did not bold well for several of the large emerging markets. India had an almost flat growth in 2015, China's growth rate fell 2.7% to 7.3%. This decrease in China, is partly driven by governmental decisions to decrease pollution and smug in the major cities such as Beijing, Shenzhen, Guangzhou and Shanghai. The governmental decision to decrease pollution could be an opportunity for Tesla and another electric vehicle manufacturer. Despite these numbers China is still expected to increase the annual vehicle sales of more than 30 m by 2020 (Wilk, 2016).

The Middle East and Africa will most likely experience growth in the industry (Wilk, 2016).

5.5.3 Size of peers

When determining the potential of Tesla, it is paramount to look at the competition and the market share the peer companies provide. While Tesla has had high revenue growth rates, it is a minor player compared to BMW, Ford, GM, Audi. As seen from the comparison in figure 5-3 below. Tesla has a revenue size of around USD 5bn, while the others are on an average of USD 120bn.

Figure 5-3 - Comparison between Tesla and peer's FY 2015 and Last twelve months.

	Tesla		**Peers**				**Average**
In USD Millions	FY 2015	Last 12M	BMW	Audi	Ford	GM	
Revenue	4,046	4,568	106,812	71,455	144,077	155,929	119,568
Cost of Goods & Services	3,123	3,591	84,221	58,998	125,025	130,682	99,731
Gross Profit	924	977	22,591	12,457	16,353	20,964	18,091
Gross Margin	**23%**	**21%**	**21%**	**17%**	**13%**	**16%**	**17%**
EBITDA	-294	-325	22,378	10,051	13,485	14,798	15,178
Operating Expenses	1,640	1,896	10,807	8,314	10,291	13,417	10,707
Selling, General & Admin	922	1,164	10,484	7,283	5,142	12,382	8,823
Research & Development	718	743	3,385	5,734	6,700		5,273
Operating Income/EBIT	-717	-919	12,117	6,820	6,062	7,560	8,140
Operating/EBIT Margin	-18%	-20%	11%	10%	4%	5%	7%
NOPAT	**-547**	**-702**	**9,254**	**5,209**	**4,630**	**5,774**	6,216

Source: Bloomberg, compiled by author.

As mentioned later in the financial analysis Tesla have produced a CAGR of 103% within the last five years. Looking at the above table, it shows that there is still a large potential market share waiting for Tesla.

5.6 The future car

During the last couple of years, the car industry has experienced an increased focus on upgrade packages including updates with “gadget” and information systems. Like many other consumer products, the modern day car is moving towards an online and *connected car* (Wilk, 2016). This increased connectivity among products, homes and cars has been championed by Internet of Things (IoT). The Internet of Things spans from your smartphone to your smart fridge. Online car (*connected car)* will besides having constant updates about traffic, weather etc. also feature vehicle to vehicle communication which should decrease the amount of traffic accidents. Furthermore, a connected car would be able to inform the driver with information from the manufacturer, this could be diagnostics and maintenance demands. A connected car will provide additional data about the users of the car - information that potentially can be valuable to many companies. This is only the first iteration of “intelligent” cars and the evolution of intelligent cars is moving towards a completely autonomous car that not only drives by itself, but interact with your calendar to plan you schedule and optimize your daily activities.

The road to a completely autonomous car is paved with a great deal of transformation for the existing car manufacturers. The company “Uber” is launching their first autonomous car within August 2016 (Bloomberg, 2016). Whether or not this is the new norm for the taxi industry remains to be seen, but the future of cars appears to have arrived. The requirements for the autonomous cars are amongst other things a redesigning of the traditional powertrain and exploring/ investing in new technologies (Wilk, 2016). The integration and importance of software in the (presumably) coming type cars is what could present a challenge to the established car manufacturers. Two different supply chains are being mixed together in order to design and develop these cars(Wilk, 2016). Being a relative new company, Tesla has incorporated this into their development cycle and could have an edge compared to more conservative American manufacturers (Tesla Motors, 2016e). This is also evident by their possible acquisition of SolarCity.

As mentioned above the integration of software into cars can present quite the challenge for some companies and this is an open invitation to high-tech companies such as Apple and Google who are beginning to produce and develop components of autonomous cars (Wilk, 2016).

The cars of the future will presumably be a cleaner and smarter version of the cars today. There is more and more focus on Carbon dioxide emission and limits are imposed throughout the world. These limits are according to standard economic theories about utility maximization going to drive customers to the segment where these fees are not imposed. That will probably be the electric vehicle (Statista, 2016).

5.7 Growth for tesla

The future revenue for Tesla looks to be growing. Two of the determine factors such as GDP growth and oil prices are both estimated to increase over the next years and this is positive for the sale of automotive vehicle (GDP growth) and for low emission vehicles (raising oil prices). The future is difficult to predict, but from the factors mentioned above, Tesla should experience raising revenues. The changes in GDP and oil prices alone is not enough to estimate the exact increase in revenue, however the outlook looks prominent. To estimate how much, it is important to look towards the peers in the automotive industry.

5.7.1 Estimation of future growth

This section will provide the reader with the future prospects for Tesla. The strategic analysis will be considered as guiding tool in the prediction, while competitors will be used as guide to what Tesla Motors could achieve in form of revenues and margins.

As seen in figure 5-4 below Tesla's operating income flow has been consistently negative since the IPO. The income statement also reveals the impact of introducing their new car, the Model S in 2013. Under the assumption that Tesla is fair valued, the discounted cash flow models dictates that the value is captured by the future growth of the company. Therefore, the forecasts in this section will be estimated under the assumption that their operating profit will produce positive cash flows in the future.

Figure 5-4 - Income statement for Tesla Motors

In USD million	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	L12M
Revenue	116.74	204.24	413.26	2,013.50	3,198.36	4,046.03	4,568.20
Cost of Goods & Services	86.01	142.65	383.19	1,557.23	2,316.69	3,122.52	3,590.90
Cost of Revenue as percent of revenue	74%	70%	93%	77%	72%	77%	79%
Gross Profit	30.73	61.60	30.07	456.26	881.67	923.50	977.30
Operating Expenses	177.57	313.08	424.35	517.55	1,068.36	1,640.13	1,896.00
Selling, General & Admin	84.57	104.10	150.37	285.57	603.66	922.23	1,164.40
Research & Development	93.00	208.98	273.98	231.98	464.70	717.90	743.20
Operating Income (Loss)	-146.84	-251.49	-394.28	-61.28	-186.69	-716.63	-918.70
NOPAT	-112.04	-191.89	-300.84	-46.76	-142.44	-546.79	-700.97
Profit margin	-96%	-94%	-73%	-2%	-4%	-14%	-15%
Interest Expense	0.73	-0.21	-0.03	32.75	99.76	117.34	150.30
Pretax Income	-154.16	-253.92	-396.08	-46.22	-284.64	-875.62	-1099.80

Source: Bloomberg, Tesla annual reports, compiled by author

5.7.2 Forecasting period

As mentioned in the description of the discounted cash flow model, the model consists of two growth periods and a stable growth period. The first growth period which account for the "abnormal" growth rates, and one period experience a decrease down towards that of the global automotive growth of 3 % (Mosquet et al., 2014). The terminal value, is the value just before the steady state period starts. To determine the growth period and the steady-state period, the strategic analysis will be applied. The future plans of Tesla with the ongoing Gigafactory and the release of their new car the "Model 3" is considered. It is assumed that when Tesla launches their Model 3 car, their revenues will spike, but after a while they will become more stable and flatten out (Tesla Motors, 2016d). Tesla's Gigafactory also plays a part in the steady-state forecast, as the factory will start production in 2017 and operate at full capacity at 2020 (Tesla Motors, 2016a). The production starts with the launch of Model 3 cars. When taking into account the launch time of Model 3, the application of the Gigafactory and the fact that Tesla's revenue has grown at a much slower rate than before, the paper anticipates their abnormal growth rate to end in 2021. This is well after the Model 3 (presumably) have hit the market in 2017 and when the Gigafactory (presumably) is near fully operational in 2020 (Tesla Motors, 2016a). The fully functional Gigafactory will ensure the demand for batteries is met, the same way as Model 3 should supply the demand for the market.

From year 2020 and forward the assumption is that Tesla would have supplied the existing demands of the market and thereby end its growth phase. This increases their total revenue, but reduce their revenue growth towards that of the global car industry.

To estimate the future revenue growth and cash flows, a time frame for the forecasting period must be selected.

5.7.3 Terminal growth

As mentioned in the section above, the forecasting period with abnormal growth will presumably end with 2021. In the section about the automotive industry, it can be seen that the industry has grown with an average of 3% a year (Hensley et al., 2009), for the last 50 years. When using the growth rate for the last 50 years, the percentage is cleared for volatility and give the general trend of the entire industry. However, having said that, there is a risk of not capturing the latest volatility of the last decades (from 2000) which have been 4% (Praem, 2014). This is a relative small difference, however because the 50 year trends experienced more than one economic crisis and assuming that recession will happen again at some point the 3% is applied.

In the strategy analysis, it is stated that the correlation of oil prices and incentive to buy electric cars is negatively correlated, it is unknown at this point how powerful the correlation is. The growth of GDP is also affecting the automotive sales because of the cyclical nature of the industry. With estimates from both The World Bank and the IMF predicting a yearly increase in global GDP (average between the two estimates) of 2.9% in 2016, 3.2% in 2017 and 3% in 2018 (World Bank only).

6 Financial statement analysis

This section of the paper sets out to introduce the reader to the financial situation of Tesla, and in combination with the strategy section to provide an estimate on the future revenue for Tesla. The following sub question will be answered in this section:

- *How has the financial performance of Tesla been since its IPO?*

Previous in the paper the WACC used for discounting the cash flow has been determined and this section aims to conclude the valuation of Tesla Motors. In order to forecast the future cash flow, it is important to understand both the historical performance and the environment in which Tesla operates. The environment is explained in the strategy section and this section aims to take those conclusions under consideration.

By analysing the previous financial statements, it can reveal how Tesla has created value, and how they have performed. Comparing Tesla to its peers provides guidance to how Tesla will perform in the future. The comparison of Tesla and peers will be done from year 2012 to the present, because Tesla started selling their Model S in 2012. To get the most recent view of the situation the two quarters up till June 30th are applied where the last twelve-month trailing is not available.

As mentioned in the introduction, Tesla's stock price has grown since the IPO in June 2010. Through the last four years from 2012 – 2015 Tesla has experienced high revenue growth, going from USD 413m in 2012 to USD 4bn in 2015. With a revenue increase of close to 1000 percent over the three years, Tesla's gross profit has similarly increased from USD 30m to USD 900m. This growth has been greatly appreciated by the shareholders who have experienced a share price increase from ~ 34 USD in December 2012 to 230 USD in August 2016. As seen from figure 5-4-income statement of Tesla, the revenue grew a lot from 2012 to 2013, but have grown at a more consistent state since then. The "trailing 12 months" is calculated by using the quarter reports from June 30th 2016 and four quarters back. Judging by the numbers Tesla have shed their abnormal growth rates that is typical in newly started companies. This indicates that their revenue will not grow at such a high rate as in the previous years.

6.1 The income statement

This section sets out to analyse the income statement and with that estimate the input for the discounted cash flow model and economic value added. Firstly, the section introduces the different relevant parts of the income statement.

The operating income shows the company's income from its operations, that is the revenue minus, cost of goods sold, depreciation, wages and other operating expenses. The operating income is a good way to get an indication of whether a business production is profitable or not (Plenborg & Petersen, 2012). Another advantage with operating income is that it is "cleared" from financial leverage.

6.1.1 Changes to the income statement

As mentioned above, the financial numbers such as operating income and NOPAT, are required for the financial analysis. However, it is only operating income that is present in the income statement presented by Tesla Motors (Tesla Motors, 2016e). The reason being it is not a requirement under the United States General Accept Accounting Principles (U.S GAAP) (PricewaterhouseCoopers, 2015).

- NOPAT is calculated as operating income * (1-Tax)

6.1.2 DuPont model

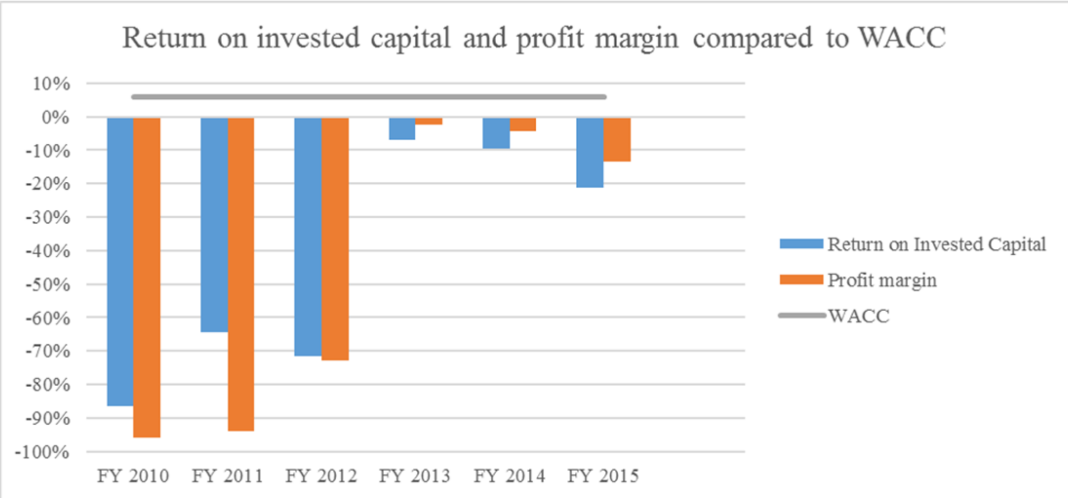
Analysis of the balance sheet is a tool to identify which components drive profitability for the company. The structure of this section will follow some parts of the DuPont model, elaborated by Petersen & Plenborg in their book (Petersen & Plenborg, 2012). The structure is shown in appendix figure a-3 is used. The WACC is explained in its own chapter, and therefore the following will focus on the following ratios, ROIC, Profit margin, and turnover ratio.

The balance sheets are created using numbers from Bloomberg where they are provided, and calculated where they are not provided. The balance sheet is dividing into two groups: assets and liabilities & shareholder's equity. For consistency the period ending June 30 with 12 month trailing numbers, is being used as comparison, and previous balance sheet snapshots are being compared to that, see appendix figure a-2 balance sheet.

6.1.2.1 Return on invested capital

For the operational performance the return on invested capital is used. Return on invested capital is a measure of how well the company allocate its capital and how well it is turned into returns. The return on invested capital is important for the later valuation of economic value added.

Figure 6-1 - Return on invested capital and profit margin compared to WACC



Source: Bloomberg and annual reports, compiled by author

The ROIC for Tesla, has been negative since they became public listed. As calculated in the weighted average cost of capital chapter, the WACC with tax shield for Tesla for that period has been 5.84%, and Tesla has therefore in that time period 2010 - 2015 failed to generate value to the shareholders.

6.1.2.2 Profit margin

The profit margin is a ratio that explains the relationship between profit and revenue. The margin is calculated as $\frac{\text{NOPAT}}{\text{Net revenues}}$ *100. Figure 5-4 in the strategy section shows the income statement of Tesla, and from that it is seen that the profit margin has increased since 2010, but is still below 0%. The recent profit margin of minus 14% indicates that Tesla is losing 14 cents for each one dollar of revenue. The profit margin shows Tesla's ability to generate profit after covering the operating expenses.

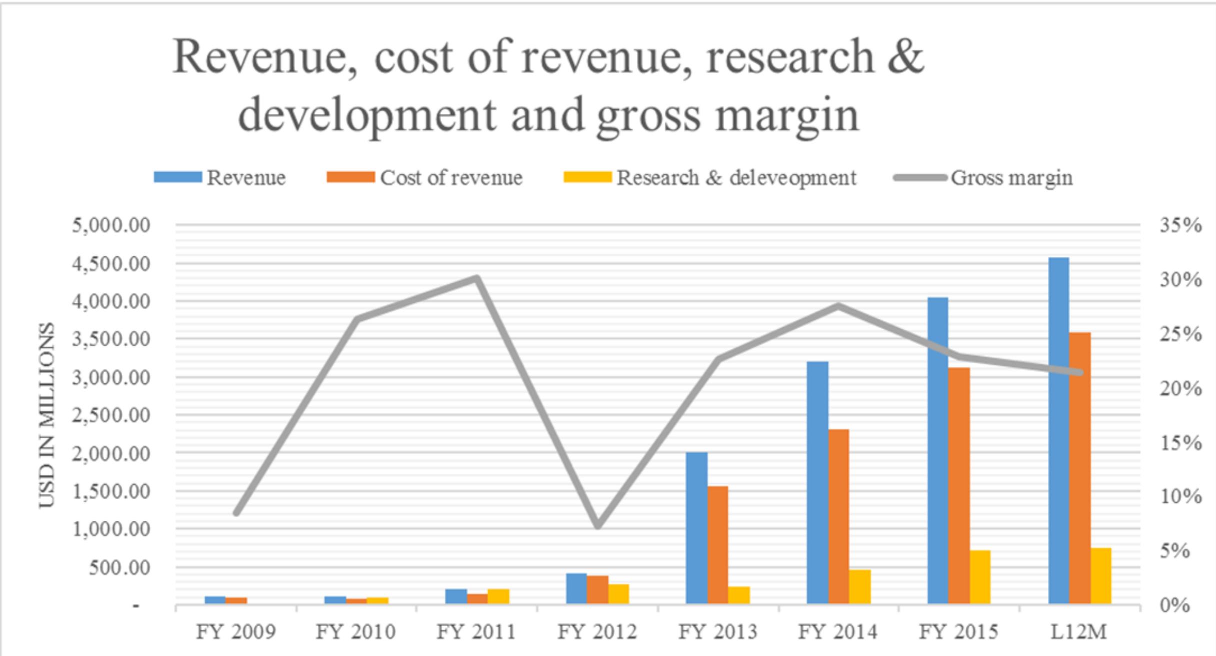
6.1.2.3 Turnover rate

The turnover rate explains the company's utilization of invested capital (Petersen & Plenborg, 2012). The rate explains how long the capital is tied up in the firm. The turnover rate for invested capital is calculated as: Net Revenue/ Invested Capital. The current turnover ratio is 0.623, see figure 8-1 in the valuation section for invested capital and figure 5-4 in strategy section for net revenue. This indicate that the invested capital is tied up in: 365/0.623 = 585 days. This is a high amount of days to have tied capital, but when considering the production facilities and the current production of the Gigafactory it is to be expected.

6.1.2.4 Revenue growth

Since Tesla went public a little over six years ago, their yearly revenues have grown at from USD 116m (end of 2009) to USD 4.5bn (12 month trailing June 2016). Their revenues have grown with a combined annual growth rate of 103% from the end of 2010 to the end of 2015.

Figure 6-2 – Revenue, cost of revenue, research and development and gross margin



Source: Bloomberg, compiled by author

As seen from figure 6- 2 above, the cost of doing business for Tesla have been around 80% of revenues since 2013. In the estimation the year 2013-2015 was used because Tesla have established their model S, and their cost of revenue have smoothed out. As mentioned in the strategic analysis, with the fully functional Gigafactory, this percentage should be expected to decrease. As seen in figure 6-1, Tesla has had negative earnings, which stems from the need to reinvest its results into R&D.

6.1.3 Benchmark and predictions

This section sets out to benchmark the current ratios of Tesla, with those of its peers. For the forecast prediction it is paramount to know where the mature companies are, and what Tesla could strive to/possible achieve. The ratios in figure 5-3 in the strategy section, shows the performance of Tesla's peers, and compares it to that of Tesla. The relationship can be used to estimate the possible future for Tesla.

As the table points out, when compared to its peers in the automotive industry, Tesla has a small part of the revenues produced by its competitors. Comparing these companies is however not entirely accurate as all the competitors develop and produce cars from low to premium segments, whereas Tesla only produces premium cars. This is about to change when Tesla launch their Model 3 car, which is aimed for the medium segment.

6.2 Sub conclusion

The financial performance of Tesla have not been good. While they have created profit, the profit has been used to reinvest to enable future growth. Doing this, they have actually destroyed value for the shareholder as seen in figure 6-1.

The forecasted free cash flow, is a seen in figure 8-1, 8-2 and 8-3 in the valuation section expected to be negative until year five in the future, where it will be positive. The present value of the next 10 years, is estimated to be: minus USD 28bn.

7 SWOT

As mention in the PESTEL analysis, it is somewhat weak on its own. In prolonging of the PESTEL analysis SWOT (Humphrey, 2005) is applied. The SWOT analysis is used to summarize the components of the PESTEL along with the findings of the financial analysis. The strategy analysis focused on the external opportunities and possible threats that could have an influence on the growth of Tesla Motors. The financial analysis sat out to investigate the financial drivers to value creation and compare these with the peers.

The findings in these section lead to the following table, summarizing the strength, weaknesses, opportunities and threats Tesla faces.

- Strengths
  - Company owned stores
  - The Gigafactory
  - Emmison credits
  - Innovative technologies
- Weaknesses
  - Bad historical ROIC
  - High operating cost
  - High R&D expenses
- Opportunities
  - Increase in oil prices
  - Global increase in GDP
  - Increase in green incentives/ emission control
- Threats
  - Reduce in oil prices in the short run
  - Electric vehicles incentive reduction
  - Competition from other car manufactures who enters the electric vehicle market.

7.1 Conclusion to future growth for Tesla

Tesla is a relative young company and new in the market. But there is no doubt that it has the potential to gain a large market share in the years to come. Both the oil price forecast and the GDP forecast are good indications that it will become more attractive to own electric vehicles. As seen in the comparison with revenues Tesla is far behind its peers. With the future launch of Model 3, and with Tesla's Gigafactory becoming operational it will increase its competitive position in the lucrative – middle market for cars. Further the push around the world towards renewable energy and away from fossil fuel will further support its position and future growth. If Tesla is able to achieve a CAGR of 60%, they will be close to the average revenue of its peers within 10 years. Considering the fact that they have achieved a CAGR for 103% for the previous five years a future CAGR for Tesla of 60% (5- years growth phase) is within its possibilities.

8 The valuation

The purpose of this section is to elaborate on the valuation model constructed to estimate the present value of Tesla Motors. The model aims to take all the observations, and assumptions made throughout the paper, and combine them into a value for Tesla Motors. The first part of the chapter will focus on the DCF model, while the second part will show the results of the EVA model. The structure of the valuation is built upon that of Stern Business School (Stern Business School, 2016).

The section will answer the following question:

- *What is the forecasted free cash flow?*

The assumptions and calculations made through the text is as follow:

- From the Weighted Average Cost of Capital section, the cost of capital is determined to be: 5.92 %
- The Industry analysis showed that Tesla Motors has the potential to expand its market share to encompass more than just the premium segment. And with its launch of Model 3 in 2017, it will cater to the "everyday" car user. Based on this it is assumed that Tesla will be able to continue expanding its revenue and move towards the revenue sizes of its peers.
- A three phase growth model is made. It is assumed that after five years they have matured with the market, and will not be able to sustain the high growth rate of 60% after that. After the first five years Tesla moves towards the stable growth 3% as determined in the strategy section.
- From the financial statement section, the historical growth rate, and the financial ratios have been determined and compared to that of its peers. From this comparison it is reasonable to assume that Tesla will increase its revenue. The profit margin of the peers is 7% on average. Tesla is now performing with a pre-tax operating margin of -20%. BMW is performing best with 11%, and Audi at 10% it is therefore assumed that Tesla will be able to reach the pre-tax operating margin of 10%.
- As of June 30 2016, Tesla has a Sales to capital ratio of 1.8. According to Stern Business School (Stern Business School, 2016), the industry average for automotive is 1.41, therefore within the forecasting period the Sales to Capital ratio will move towards 1.41 and reaching it when entering the stable growth phase.

8.1 Discounted cash flow model

As explained in the theory section this model uses the free cash flows to firm, and discount them backwards to the present. As the value of the firm, depends on uncertain future cash flows, the model calculates these with use of the revenue growth rate from the strategy section, and the cost of capital from the WACC section.

The free Cash flow to firm model estimates a terminal value of USD 110.8bn. When discounted to the present with cost of capital of 5.86% this gives a present value of USD 62.7bn. The present value of the cash flows is USD - 28.1bn. This give a present value of Tesla of USD 34.5bn. With 147.7m shares outstanding that gives a share price of USD 231.9. When compared to the price of 230.03 as of June 30 2016, the value of the share is valued at 99.18% of Tesla's intrinsic value

The economic value added estimates the total economic value added to be USD 28 bn. With initial invested capital of USD 7.2bn, the value of the company is estimated to be USD 35.2bn. With 147.7m shares outstanding that gives a share price of USD 236.04. When compared to the price of 230.03 as of June 30 2016, the value of the share is valued at 97.45% of Tesla's intrinsic value

In theory the discounted cash flow model and economic value added model should give the same result as they are mathematically derived from each other (Adserà et al., 2003). As the use of weighted average cost of capital is a large component in both DCF and EVA especially in "terminal value" of EVA, where it is both in the numerator and denominator it's apparent that miscalculation of WACC leads to an inconsistent result.

When comparing these results, it is arguably that both the EVA and DCF model to some extend captures the future value of Tesla Motors. As both EVA and DCF Tesla slightly overvalued it is arguably that both methods, to a large extend are capable of capturing the value the company.

Figure 8-1 - The valuation model with future cash flow for the growth phase

In millions USD	LTM	2017	2018	2019	2020	2021
Revenue growth rate		60%	60%	60%	60%	60%
Revenues	$ 4,484.00	$ 7,174.40	$ 11,479.04	$ 18,366.46	$ 29,386.34	$ 47,018.14
Operating margin (EBIT)	-20.49%	-17.44%	-11.95%	-5.37%	0.78%	5.39%
Operating income (EBIT)	$ -918.70	$ -1,251.18	$ -1,371.93	$ -985.56	$ 229.31	$ 2,534.36
Tax rate	23.64%	23.64%	23.64%	23.64%	23.64%	23.64%
Earnings before Interest	$ -918.70	$ -1,251.18	$ -1,371.93	$ -985.56	$ 229.31	$ 2,534.36
- Reinvestment		$ 1,530.69	$ 2,504.14	$ 4,098.72	$ 6,712.25	$ 10,998.36
Free Cash Flow Firm		$ -2,781.87	$ -3,876.07	$ -5,084.29	$ -6,482.94	$ -8,464.00
NOL		$ 1,251.18	$ 2,623.11	$ 3,608.67	$ 3,379.36	$ 845.00
NOPAT	$ -701.52	$ -955.40	$ -1,047.60	$ -752.58	$ 175.10	$ 1,935.23
Cost of capital		5.84%	5.84%	5.84%	5.84%	5.84%
Cumulated discount factor		94.50%	89.30%	84.39%	79.75%	75.29%
PV Free Cash Flow Firm		$ -2,628.89	$ -3,461.49	$ -4,290.79	$ -5,170.28	$ -6,372.87
Economic Value Added		$ -1,383.02	$ -1,519.44	$ -1,388.19	$ -883.52	$ -16.11
Sales to capital ratio	1.80	1.76	1.72	1.68	1.64	1.60
Invested capital	$ 7,200.83	$ 8,731.53	$ 11,235.67	$ 15,334.39	$ 22,046.64	$ 33,044.99
ROIC	-12.8%	-14.3%	-12.2%	-6.4%	1.0%	7.7%

Figure 8-2 - The valuation model from year 6- terminal

In millions USD	2022	2023	2024	2025	2026	Terminal year
Revenue growth rate	49%	30%	14%	5%	3%	3%
Revenues	$ 69,868.95	$ 91,081.17	$ 103,781.52	$ 109,166.54	$ 112,441.54	$ 115,814.78
Operating margin (EBIT)	8.16%	9.45%	9.89%	9.99%	10.00%	10.00%
Operating income (EBIT)	$ 5,698.56	$ 8,604.27	$ 10,263.33	$ 10,904.58	$ 11,244.15	$ 11,581.48
Tax rate	23.64%	23.64%	23.64%	23.64%	23.64%	23.64%
Earnings before Interest	$ 4,551.18	$ 6,570.22	$ 7,837.08	$ 8,326.73	$ 8,586.04	$ 8,843.62
- Reinvestment	$ 14,605.79	$ 13,901.64	$ 8,539.48	$ 3,717.33	$ 2,322.69	$ 2,392.37
Free Cash Flow Firm	$ -10,054.61	$ -7,331.42	$ -702.40	$ 4,609.41	$ 6,263.34	$ 6,451.24
NOL	-	-	-	-	-	-
NOPAT	$ 4,351.42	$ 6,570.22	$ 7,837.08	$ 8,326.73	$ 8,586.04	$ 8,843.62
Cost of capital	5.84%	5.84%	5.84%	5.84%	5.84%	5.84%
Cumulated discount factor	71.08%	67.11%	63.36%	59.87%	56.58%	
PV Free Cash Flow Firm	$ -7,147.28	$ -4,920.17	$ -445.03	$ 2,759.87	$ 3,543.94	
Economic Value Added	$ 1,083.29	$ 1,955.74	$ 2,326.84	$ 2,423.29	$ 2,360.54	$ 23,041.33
Sales to capital ratio	1.56	1.53	1.49	1.45	1.41	1.41
Invested capital	$ 47,650.78	$ 61,552.42	$ 70,091.90	$ 73,809.23	$ 76,131.92	$ 78,524.29
ROIC	9.6%	10.7%	11.2%	11.3%	11.3%	11.3%

Figure 8-3 - Result of the valuation

In millin USD except share price	
Terminal cash flow	6,451.24
Terminal cost of capital	5.84%
Terminal value	110,467.11
PV(Terminal value)	62,366.82
PV (CF over next 10 years)	-28,113.48
Sum of PV	34,253.35
- Debt	3,246.83
+ Cash	3,246.30
Value of equity	34,252.82
Number of shares	147680
Price on valuation date	231.94
DCF Estimated value /share	230.03
Price as % of value	99.18%
Sum of EVA	27,657.41
Invested Capital	7,200.83
Value of Company	34,858.24
EVA Estimated value /share	236.04
Price as % of value	97.45%

It can be seen from the valuation that the present value of the forecasted free cash flow is USD -28,132bn. The valuation of economic value added and discounted cash flow should give the same result as they are derived from each other, however the difference of 1.7% is negligible. As the discount rate used is the same, the difference stems from either the nominator in the equation, that is either the free cash flow or economic value added. As mentioned earlier the risk of using EVA is that the wrong initial cost of investment could be applied.

9 Sensitivity analysis

This chapter sets out to answer the following question from the problem statement:

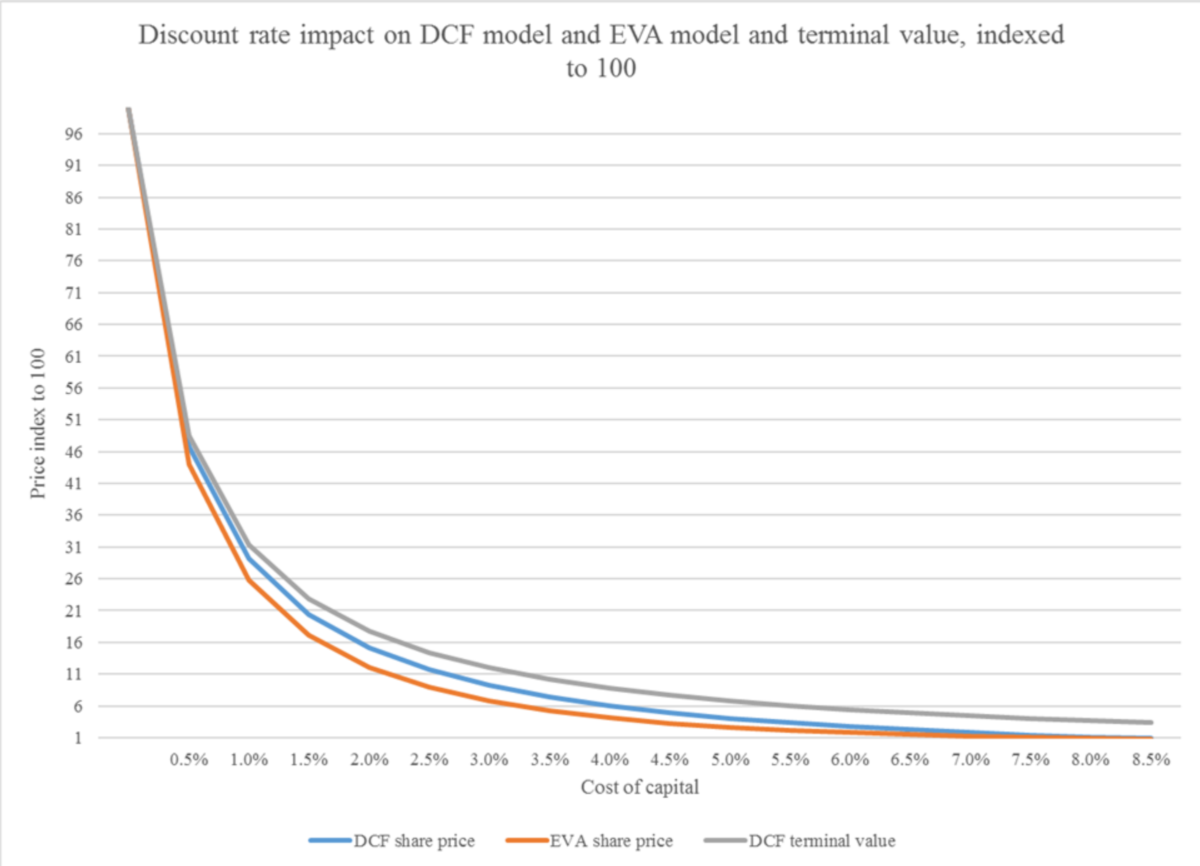
- *What are the consequences of calculating the wrong cost of capital?*
- *How sensitive is the discount discounted cash flow model and economic value added model to the input made by the analyst?*
- *What is the impact on the predicted share price if the Equity Risk Premium or the beta is wrongly estimated?*

To answer these question the results from the valuation will be used as guideline. Further it is important to understand that when asking the question of what the consequenses are, the question revoles around the use of theory, that is, if the model is sensible to changes in the discount rate, how will that influence the usefullness of the the models.

This section will show the impact from cost of capital on the share price, and how sensible the methods are to changes in CAPM and revenue growth.

As seen from figure e-1 in the appendix, as the cost of capital increases the the share price decreases in both the DCF and EVA valuation. From the figure it becomes clear that the EVA method is more sensible to changes in the discount rate than the discounted cash flow method. It can be seen that the average change in discount rate of 0.5% has an average effect of ~ 3.2 times on the EVA relative to DCF. This shows the sensitivity of different discount rates depends on the which valuation method is applied. From the data it is concluded that the impact of discount rate is very prominent when applying EVA but not as grave when using DCF. The impact is very high when the discount rate is low, but it evens out as the discount rate increases. It is however worth noting that since the terminal value accounts for more than 144% of the value of Tesla, factors that that impact that value has a large effect. As seen in the figure below, there is a close relationship between the EVA and DCF. From the data in figure e-1 in appendix and figure 9-1 below, the conclusion is that the discount rate of free cash flow and economic value added is important. However as soon as the discount rate reaches around 6% the trend reverses and the impact on the DCF model becomes larger. Therefore, both models are very sensitive when the discount rate is low, but as the discount rate increases, the sensitivity drops.

Figure 9-1 - The impact from discount rate on share price and terminal value – index to 100 with discount rate = 0.5%



As seen from the figure above, the impact starts out being higher on EVA, but shifts at 6% to being higher on the DCF model.

9.1 Equity risk premium, beta and risk free return

This section will provide the reader with the conclusion to the following sub question:

- *What is the impact on the discount rate if the equity risk premium or the beta or the risk free return is wrongly estimated?*

As mentioned above, the terminal value has a significant impact on the share price in the case of Tesla. As stated in the WACC chapter, Tesla is financed with 90% equity, therefore when looking at the cost of capital, cost of equity is by far the most dominat. This section will look at the impact of equity risk premium, risk free rate and beta on the cost of equity. The cost of equity is calculated by the capital asset pricing model explained in the valuation theory chapter. From the theory capital asset pricing model developed by (Sharpe, 1964) we know that the expected return is calculated as:

$$E(R_i) = R_f + \beta * (RP_m)$$

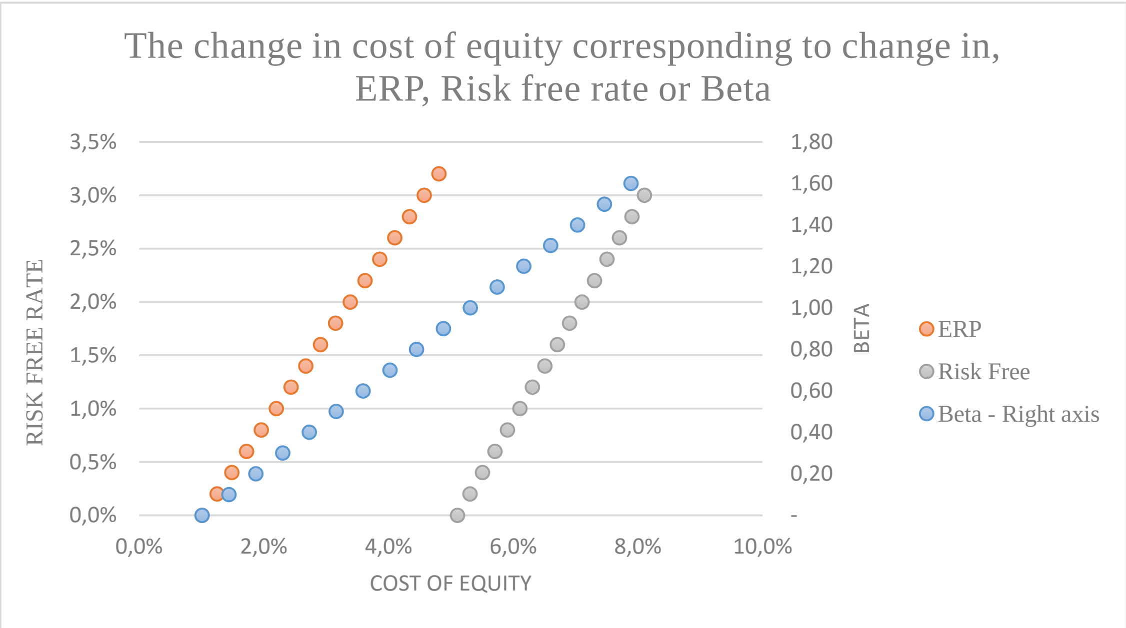
As seen from the equation if the constants are held equal, the impact of each of the different variables are linear. Figure 9-2 - correlation between (ERP, risk free, beta), shows the increase in cost of equity with an increase in either ERP, risk free rate or beta.

As argued in the cost of equity section in the WACC chapter, the cost of equity and the beta are largely influenced by the market, competition and economic growth.

To understand the impact of the equity risk premium and the beta on the predicted shareprice – the revenue growth rate is assumed to be constant.

As seen form figure 9–2 below, the impact on cost of equity is rather significant when the other variables are heldt constant. There are a lot of assumptions going into estimating and calculating each compoment in the cost of equtiy, from the data below it shows that calculating the beta wrongly is the most consequntial error and could lead to a wrong cost of equity, and thereby a wrong valuation.

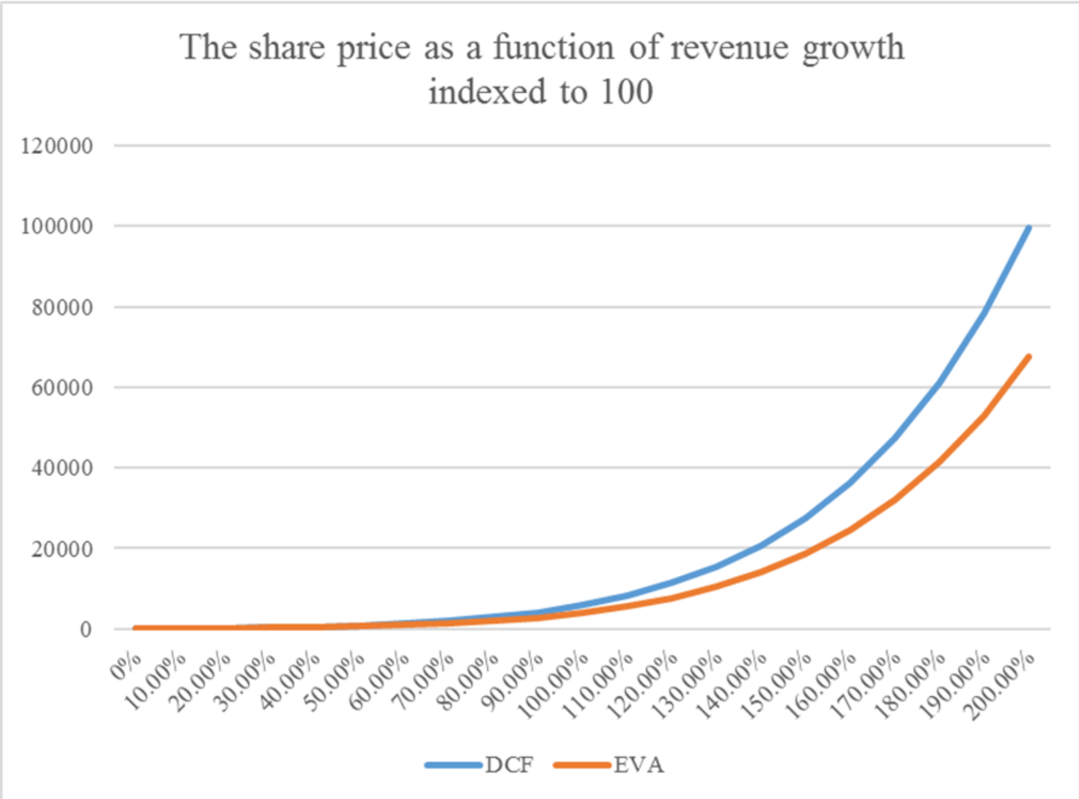
Figure 9-2 - The increase in cost of equity on x-axis, with an increase of either 0.1 beta or 0.2% ERP or Risk Free



9.2 The importance of future growth prediction

While this paper has focused on the discount rate, the future growth is likewise a component in the valuation. To analyses whether the impact of the discount factor is large it is necessary to compare it to the impact of the revenue growth rate. The following figure shows the impact of the growth rate on both the discounted cash flow model and the economic value added model. The figure is set to index 100.

Figure 9-3 - Revenue growth impact on share price DCF and EVA - Index 100



As seen from the figure the impact is increasing, which is to be expected since the revenue is compounded.

During the strategy analysis it is estimated that Tesla will be able to contain 60% compounded growth for 5 years. If the assumption is wrong and they would be able to maintain it for 6 years, the share price would be USD 346 instead of the estimated USD 230 per share with DCF and USD

352 instead of USD 236 with EVA. This is evident that the revenue growth is paramount to valuating the company.

10 Future research & valuation

This section sets out to establish what future research that can be done within valuation theories and specific in the case of Tesla Motors.

While the discounted cash flow offers many forces, there is a few pitfalls. To capture some of these pitfalls and the pitfalls of EVA models such as FEVA offers opportunities for to ratify these shortcomings.

10.1 FEVA – the new valuation approach

Modigliani and Miller (1963) established that the value of a company consist of three components. The negative value created by bankruptcy risk, the unleveraged value of the company and the value of tax shield stemming from the debt position(Modigliani & Miller, 1963). As mentioned in the delimitations section, there are several pitfalls with both DCFs and EVA model. To get around these pitfalls, Xavier Adserà and Pere Viñolas, created a new model. In their paper "FEVA: A Financial and Economic Approach to Valuation", they argue that DCF, EVA and Modigliani and Miller's model all should provide the same result (Adserà et al., 2003). To eliminate some of the limitations from EVA, where equity value is used on both side of the equation, they came up with a new model which incorporates elements from the three methods.

$$E = C_I + \frac{C_I(r_0 - k_u)}{k_u} + \frac{EBIT(1-t)}{k_u}\left(\frac{r_u - k_u}{r_u}\right)\left(\frac{g}{k_u - g}\right) + tD + \frac{tDg}{k_u - g} - \frac{D(1-t)(i - R_f)}{k_u} - \frac{D(1-t)(i-R_f)g}{k_u(k_u - g)} - D$$

Where

C_I = initial cash or capital invested

r_0 = (EBIT(1-t))/ C_I = the return on capital invested

tD = tax shield from existing debt

k_u = unlevered cost of equity

I = net investment (excluding depreciation)

i = expected yield of debt

R_f = risk-free rate

$r_u = (g(EBIT)(1-t))/I$

The formula's strength is that it explains the value drivers more in depth as it differentiates the corporate value drivers. The formula allows the analyst to evaluate which drivers of the company that are profitable. This method is useful for very complex companies, where the normal used methods do not provide an adequate result. (Adserà et al., 2003) argues that this method is particularly relevant when evaluating start-up companies. Start-up companies and growth companies tend to destroy value, because they have to finance their growth. This is the case for Tesla, and this method should be considered when doing valuation of start-ups and growth companies.

10.2 SolarCity

As mentioned in the delimitation section, Tesla have made a tender to acquire SolarCity. If the deal goes through Tesla will expand their production line. With this change in their business structure, not only will their future growth change, but the beta will be changed as the company now identifies differently.

10.3 Revenue growth – more important than discount rate?

While this paper has focused on the discount rate as the predominant factor in the present value, the data from the paper suggest that while the discount rate is important, determining the correct revenue growth is equally important. As seen from figure 9-3 in the sensitivity chapter – there is a difference in the reaction between DCF and EVA when isolating for revenue growth. A future study could examine this relationship closer.

11 Conclusion

The purpose of this paper was to do an analysis of the share price of Tesla Motors and thus determine whether the increase in Tesla share price is warranted in the fundamentals of the company. The paper demonstrated that valuation with both the discounted free cash flow model and the economic value added estimated Tesla's share price to be 99.18% and 97.45% of the intrinsic value of the company. The DCF and EVA model valuates Tesla at an average value per share of USD 233.9 and it is deduced that the stock price rise is warranted in the current fundamentals. It was discovered that both valuation methods were as expected susceptible to change in the discount rate. This stemmed primarily from the fact that more than 144% of the value of the company is captured in the terminal value. The applying discount rate is then compounded back and therefore is a small change in discount rate catalyst to a large change in present value.

As demonstrated in the sensitivity analysis, the terminal value becomes a large part of the valuation and assumptions made to the terminal value are therefore largely influential on the outcome.

The two valuation models are very sensitive to the input of the discount factor. Usually when the valuation models is applied there is tendency to use industry based cost of capital. From the sensitivy analysis it is learned that using a wrong cost of capital can lead to a drastic change is estimated value.

The two models mentioned above capturing the value of the firm, the "perfect" valuation method must be somewhere in between these two. As mentioned in the section of future study the valuation method of FEVA (Adserà et al., 2003) is introduced. As this theory is mathematically derived from both EVA and DCF, it could potentially capture the entire value of Tesla. The valuation model presented by (Adserà et al., 2003) is better for calculating value for new companies who tend to have negative ROIC, which is what Tesla has.

As argued in the weighted average cost of capital chapter, the cost of equity for Tesla is 6.12%. The cost of equity is an important part of the valuation of Tesla, as the equity accounts for ~ 90% of the value of the company. As the cost of equity is dependent on both the equity risk premium, risk free rate and beta, the correct selection of industry and market index becomes paramount. As seen from the sensitivity analysis, the impact on the share price from the change in the discount rate is high and therefore using the correct values becomes paramount when valuating. Had the beta listed on NASDAQ (0.66) been applied instead the valuation would have shown a share value of ~ 600 USD with DCF and a cost of equity of ~ 3.7%. From this the paper concludes that even though the calculated cost of equity is 6.12% the assumptions about the input in the model plays a significant part in the valuation. As briefly mentioned above, the cost of equity is a large part of the cost of capital for Tesla Motor, while this not necessarily the case in other companies, the impact on the share price from changes in discount rate is the same. Demonstrated in the sensitivity analysis, the cost of capital has a linear impact on both the DCF and EVA models, but has a steep impact on the terminal value of DCF. Since the terminal value accounts for ~144% of the valuation of Tesla, the consequence of calculating the wrong discount rate is grave.

12 Literature

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Appendix a – Financial Statement

Figure a-1 – Historical balance sheet

In Millions of USD						
Assets	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015
Cash	99.56	280.33	201.89	845.89	1,905.71	1,196.91
Accounts & Notes Receiv	6.71	9.54	26.84	49.11	226.60	168.97
Inventories	45.18	50.08	268.50	340.36	953.68	1,277.84
Other ST Assets	84.44	32.89	27.53	30.59	94.08	147.86
Total Current Assets	235.89	372.84	524.77	1,265.94	3,180.07	2,791.57
Property, Plant & Equip, Net	114.64	298.41	552.23	738.49	1,829.27	3,403.33
+ Property, Plant & Equip	136.63	330.64	609.77	878.64	2,121.86	3,974.46
- Accumulated Depreciation	21.99	32.22	57.54	140.14	292.59	571.13
+ Other LT Assets	35.56	42.20	37.19	412.50	821.33	1,897.56
Total Noncurrent Assets	**150.20**	340.61	589.42	1,150.99	2,650.59	5,300.89
Total Assets	**386.08**	713.45	1,114.19	2,416.93	5,830.67	8,092.46
Liabilities & Shareholders' Equity						
Payables & Accruals	49.90	88.25	343.18	414.35	1,050.40	1,338.95
ST Debt	0.28	8.98	55.21	7.90	669.30	675.21
Other ST Liabilities	35.39	94.11	140.72	252.90	445.67	844.16
Total Current Liabilities	85.57	191.34	539.11	675.16	2,165.36	2,858.32
LT Debt	72.32	271.17	411.46	598.97	1,818.79	2,040.38
Other LT Liabilities	21.15	26.90	38.92	475.68	934.81	2,104.82
Total Noncurrent Liabilities	93.47	298.06	450.38	1,074.65	2,753.60	4,145.20
Total Liabilities	**179.03**	**489.40**	**989.49**	**1,749.81**	**4,918.96**	**7,003.52**
Total Equity	207.05	224.05	124.70	667.12	911.71	1,088.94
Total Liabilities & Equity	**386.08**	**713.45**	**1,114.19**	**2,416.93**	**5,830.67**	**8,092.46**

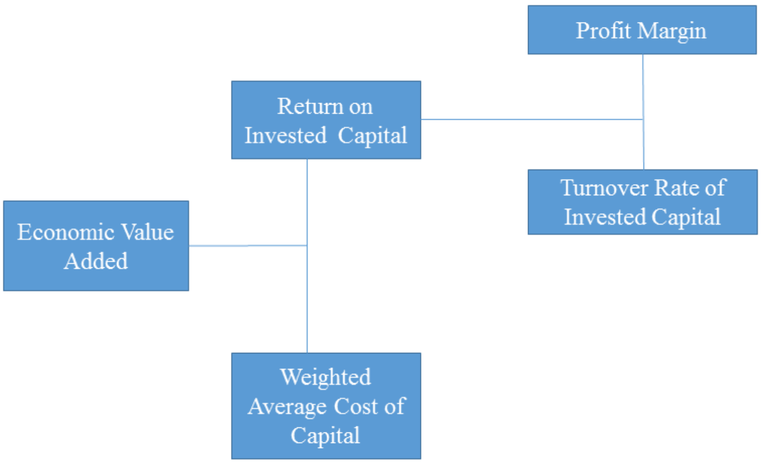
Source: Bloomberg, (Tesla Motors, 2014), (Tesla Motors, 2013), (Tesla Motors, 2012)(Tesla Motors, 2011), *compiled by author*

Figure a-2 – Balance sheet as of June 30 2016

Assets		**Liabilities & Shareholders' Equity**	
Cash	3,246.30	Payables & Accruals	1,673.10
Accounts & Notes Receiv	178.6	ST Debt	626.8
Inventories	1,609.60	Other ST Liabilities	1,466.50
Other ST Assets	169.2		
Total Current Assets	**5,203.70**	**Total Current Liabilities**	**3,766.40**
Property, Plant & Equip, Net	3,993.30	+ LT Debt	2,620.00
+ Property, Plant & Equip	4,777.20	+ Other LT Liabilities	2,925.10
- Accumulated Depreciation	784		
+ Other LT Assets	2,672.00		
Total Noncurrent Assets	**6,665.20**	**Total Noncurrent Liabilities**	**5,545.10**
Total Assets	**11,869.00**	**Total Liabilities**	**9,311.50**
		Total Equity	2,557.40
		Total Liabilities & Equity	**11,869.00**

Source: Bloomberg, , *compiled by author*

Figure a--3 - First layer of DuPont pyramid



Source: Financial Statement Analysis (Petersen & Plenborg, 2012)

Appendix b – Sensitivity discounted cash flow

Figure b-1 - DCF model with beta and risk free rate

Beta/Risk Free													
234.25	0.2%	0.4%	0.6%	0.8%	1.0%	1.2%	1.4%	1.6%	1.8%	2.0%	2.2%	2.4%	2.6%
0.10	4,220.22	3,414.39	2,840.59	2,411.68	2,079.28	1,814.39	1,598.56	1,419.50	1,268.71	1,140.11	1,029.25	932.79	848.19
0.20	2,768.51	2,356.54	2,035.79	1,779.24	1,569.60	1,395.25	1,248.13	1,122.44	1,013.93	919.40	836.39	762.99	697.68
0.30	1,993.72	1,745.14	1,541.42	1,371.61	1,228.02	1,105.16	998.93	906.27	824.81	752.71	688.51	631.02	579.31
0.40	1,514.01	1,348.55	1,208.39	1,088.25	984.23	893.39	813.44	742.61	679.48	622.92	572.00	525.96	484.16
0.50	1,189.20	1,071.70	969.83	880.75	802.27	732.68	670.60	614.94	564.80	519.43	478.23	440.68	406.34
0.60	955.71	868.35	791.30	722.92	661.87	607.09	557.70	513.00	472.37	435.33	401.45	370.36	341.77
0.70	780.53	713.32	653.28	599.36	550.72	506.66	466.60	430.06	396.61	365.92	337.68	311.64	287.56
0.80	644.82	591.74	543.83	500.41	460.91	424.85	391.84	361.54	333.64	307.90	284.10	262.04	241.57
0.90	537.05	494.24	455.29	419.71	387.13	357.21	329.65	304.21	280.69	258.88	238.62	219.78	202.23
1.00	449.75	414.65	382.48	352.93	325.70	300.57	277.31	255.74	235.71	217.07	199.70	183.48	168.32
1.10	377.89	348.70	321.81	296.96	273.97	252.64	232.83	214.39	197.19	181.14	166.14	152.09	138.92
1.20	317.95	293.40	270.67	249.58	229.98	211.73	194.72	178.83	163.97	150.06	137.02	124.78	113.28
1.30	267.40	246.55	227.16	209.10	192.26	176.54	161.82	148.05	135.13	123.01	111.61	100.89	90.80
1.40	224.37	206.50	189.84	174.27	159.70	146.06	133.26	121.25	109.96	99.34	89.34	79.92	71.03
1.50	187.43	172.02	157.60	144.09	131.41	119.51	108.33	97.80	87.89	78.55	69.74	61.42	53.56
1.60	155.51	142.13	129.58	117.79	106.71	96.28	86.46	77.20	68.46	60.22	52.42	45.06	38.09

Figure b-2 - DCF model with beta and equity risk premium

Beta/ERP													
234.25	0.0%	0.5%	1.0%	1.5%	2.0%	2.5%	3.0%	3.5%	4.0%	4.5%	5.0%	5.5%	6.0%
0.10	2,890.41	2,768.51	2,654.94	2,548.88	2,449.63	2,356.54	2,269.08	2,186.74	2,109.11	2,035.79	1,966.43	1,900.74	1,838.42
0.20	2,890.41	2,654.94	2,449.63	2,269.08	2,109.11	1,966.43	1,838.42	1,722.96	1,618.32	1,523.06	1,436.01	1,356.17	1,282.70
0.30	2,890.41	2,548.88	2,269.08	2,035.79	1,838.42	1,669.38	1,523.06	1,395.25	1,282.70	1,182.90	1,093.84	1,013.93	941.87
0.40	2,890.41	2,449.63	2,109.11	1,838.42	1,618.32	1,436.01	1,282.70	1,152.11	1,039.64	941.87	856.18	780.53	713.32
0.50	2,890.41	2,356.54	1,966.43	1,669.38	1,436.01	1,248.13	1,093.84	965.09	856.18	762.99	682.47	612.31	550.72
0.60	2,890.41	2,269.08	1,838.42	1,523.06	1,282.70	1,093.84	941.87	817.21	713.32	625.61	550.72	486.16	430.06
0.70	2,890.41	2,186.74	1,722.96	1,395.25	1,152.11	965.09	817.21	697.68	599.36	517.28	447.92	388.70	337.68
0.80	2,890.41	2,109.11	1,618.32	1,282.70	1,039.64	856.18	713.32	599.36	506.66	430.06	365.92	311.64	265.25
0.90	2,890.41	2,035.79	1,523.06	1,182.90	941.87	762.99	625.61	517.28	430.06	358.64	299.36	249.58	207.37
1.00	2,890.41	1,966.43	1,436.01	1,093.84	856.18	682.47	550.72	447.92	365.92	299.36	244.55	198.86	160.41
1.10	2,890.41	1,900.74	1,356.17	1,013.93	780.53	612.31	486.16	388.70	311.64	249.58	198.86	156.90	121.83
1.20	2,890.41	1,838.42	1,282.70	941.87	713.32	550.72	430.06	337.68	265.25	207.37	160.41	121.83	89.83
1.30	2,890.41	1,779.24	1,214.88	876.59	653.28	496.29	380.94	293.40	225.29	171.27	127.76	92.28	63.05
1.40	2,890.41	1,722.96	1,152.11	817.21	599.36	447.92	337.68	254.71	190.64	140.20	99.86	67.19	40.48
1.50	2,890.41	1,669.38	1,093.84	762.99	550.72	404.70	299.36	220.69	160.41	113.28	75.85	45.77	21.36
1.60	2,890.41	1,618.32	1,039.64	713.32	506.66	365.92	265.25	190.64	133.88	89.83	55.10	27.39	5.07

Figure b-3 - DCF model with risk free rate and equity risk premium

ERP/Risk Free													
234.25	0.2%	0.4%	0.6%	0.8%	1.0%	1.2%	1.4%	1.6%	1.8%	2.0%	2.2%	2.4%	2.6%
0	7,887.38	5,669.22	4,370.00	3,517.56	2,915.87	2,468.96	2,124.28	1,850.63	1,628.34	1,444.38	1,289.78	1,158.17	1,044.89
0.5%	3,540.19	2,932.32	2,481.44	2,134.05	1,858.48	1,634.78	1,449.76	1,294.33	1,162.07	1,048.26	949.39	862.79	786.39
1.0%	2,143.89	1,866.39	1,641.26	1,455.16	1,298.90	1,165.98	1,051.64	952.34	865.39	788.69	720.59	659.78	605.21
1.5%	1,460.60	1,303.50	1,169.91	1,055.04	955.31	868.00	790.99	722.64	661.62	606.87	557.50	512.82	472.21
2.0%	1,058.46	958.29	870.61	793.31	724.70	663.47	608.53	559.00	514.18	473.45	436.31	402.34	371.19
2.5%	795.63	726.77	665.32	610.19	560.51	515.54	474.69	437.44	403.38	372.14	343.41	316.92	292.45
3.0%	611.86	562.01	516.91	475.93	438.58	404.42	373.10	344.29	317.74	293.20	270.48	249.41	229.82
3.5%	477.18	439.72	405.47	374.06	345.17	318.55	293.95	271.18	250.05	230.42	212.14	195.10	179.19
4.0%	375.02	346.06	319.37	294.71	271.88	250.70	231.02	212.71	195.63	179.68	164.76	150.80	137.71
4.5%	295.47	272.58	251.36	231.63	213.27	196.15	180.17	165.23	151.23	138.12	125.81	114.25	103.38
5.0%	232.24	213.84	196.68	180.66	165.69	151.67	138.53	126.19	114.61	103.71	93.46	83.80	74.69
5.5%	181.16	166.15	152.10	138.93	126.57	114.97	104.05	93.78	84.10	74.97	66.36	58.23	50.55
6.0%	139.34	126.96	115.33	104.39	94.10	84.40	75.26	66.63	58.49	50.79	43.51	36.62	30.10
6.5%	104.73	94.42	84.70	75.54	66.90	58.74	51.03	43.74	36.84	30.31	24.12	18.26	12.70
7.0%	75.83	67.17	58.99	51.27	43.96	37.05	30.51	24.31	18.44	12.87	7.59	2.58	-2.17
7.5%	51.51	44.19	37.27	30.71	24.51	18.62	13.05	7.76	2.74	-2.03	-6.55	-10.85	-14.94

Appendix c - Sensitivity economic value added

Figure c-1 - EVA model with equity risk premium and risk free rate

ERP/Risk Free													
238.36	**0.0%**	**0.2%**	**0.4%**	**0.6%**	**0.8%**	**1.0%**	**1.2%**	**1.4%**	**1.6%**	**1.8%**	**2.0%**	**2.2%**	**2.4%**
0.0%	16,272.15	10,098.41	7,155.30	5,439.37	4,319.68	3,534.31	2,955.01	2,511.60	2,162.43	1,881.21	1,650.58	1,458.57	1,296.69
0.5%	5,482.93	4,349.32	3,555.70	2,971.12	2,524.12	2,172.40	1,889.33	1,657.29	1,464.20	1,301.45	1,162.80	1,043.57	940.21
1.0%	2,987.36	2,536.74	2,182.45	1,897.50	1,664.04	1,469.85	1,306.25	1,166.91	1,047.12	943.29	852.66	773.04	702.69
1.5%	1,905.71	1,670.83	1,475.53	1,311.06	1,171.03	1,050.67	946.39	855.37	775.43	704.81	642.11	586.18	536.09
2.0%	1,315.90	1,175.17	1,054.25	949.50	858.09	777.83	706.93	644.00	587.87	537.61	492.41	451.63	414.72
2.5%	952.62	860.83	780.23	709.07	645.90	589.57	539.13	493.78	452.87	415.84	382.23	351.62	323.68
3.0%	711.21	647.80	591.27	540.65	495.16	454.12	416.97	383.25	352.56	324.54	298.90	275.39	253.78
3.5%	542.19	496.54	455.36	418.10	384.28	353.49	325.39	299.68	276.11	254.44	234.48	216.06	199.04
4.0%	419.23	385.31	354.43	326.25	300.47	276.83	255.10	235.09	216.63	199.56	183.75	169.09	155.46
4.5%	327.11	301.26	277.55	255.77	235.71	217.20	200.08	184.24	169.54	155.88	143.17	131.33	120.27
5.0%	256.43	236.32	217.76	200.61	184.73	169.99	156.30	143.56	131.69	120.61	110.26	100.57	91.49
5.5%	201.14	185.21	170.44	156.72	143.96	132.06	120.95	110.58	100.87	91.77	83.23	75.22	67.68
6.0%	157.15	144.35	132.42	121.30	110.90	101.17	92.05	83.50	75.47	67.91	60.80	54.10	47.78
6.5%	121.64	111.22	101.47	92.33	83.76	75.71	68.15	61.02	54.31	47.98	42.00	36.34	31.00
7.0%	92.62	84.03	75.96	68.38	61.24	54.52	48.17	42.18	36.52	31.16	26.09	21.28	16.71
7.5%	68.62	61.47	54.73	48.37	42.37	36.70	31.33	26.24	21.43	16.86	12.51	8.39	4.47

Figure c-2 - EVA model with beta and risk free rate

Beta/Risk Free													
238.36	**0.0%**	**0.2%**	**0.4%**	**0.6%**	**0.8%**	**1.0%**	**1.2%**	**1.4%**	**1.6%**	**1.8%**	**2.0%**	**2.2%**	**2.4%**
0.1	6,842.25	5,242.18	4,184.66	3,436.44	2,881.09	2,453.99	2,116.41	1,843.74	1,619.56	1,432.54	1,274.59	1,139.79	1,023.68
0.2	4,056.41	3,342.83	2,810.01	2,398.37	2,071.85	1,807.34	1,589.37	1,407.16	1,253.02	1,121.27	1,007.66	908.92	822.52
0.3	2,741.62	2,344.64	2,028.67	1,771.98	1,559.97	1,382.41	1,231.95	1,103.16	991.97	895.23	810.49	735.83	669.69
0.4	1,986.80	1,737.63	1,531.35	1,358.26	1,211.36	1,085.45	976.60	881.80	798.69	725.40	660.42	602.55	550.77
0.5	1,503.47	1,334.70	1,191.24	1,068.12	961.55	868.64	787.11	715.16	651.32	594.41	543.47	497.69	456.41
0.6	1,171.58	1,051.15	946.81	855.74	775.75	705.09	642.36	586.41	536.29	491.23	450.56	413.75	380.33
0.7	932.36	843.08	764.59	695.21	633.56	578.54	529.23	484.86	444.81	408.53	375.58	345.56	318.14
0.8	753.64	685.50	624.91	570.80	522.28	478.59	439.14	403.39	370.90	341.29	314.23	289.46	266.71
0.9	616.41	563.19	515.43	472.42	433.55	398.32	366.28	337.07	310.38	285.92	263.46	242.80	223.74
1	508.69	466.34	428.05	393.32	361.73	332.92	306.57	282.43	260.25	239.84	221.01	203.62	187.51
1.1	422.62	388.39	357.24	328.81	302.82	278.98	257.08	236.92	218.32	201.12	185.20	170.43	156.71
1.2	352.81	324.77	299.11	275.58	253.95	234.03	215.65	198.66	182.91	168.31	154.74	142.11	130.33
1.3	295.45	272.22	250.86	231.18	213.02	196.22	180.65	166.21	152.78	140.29	128.64	117.76	107.59
1.4	247.81	228.36	210.41	193.81	178.42	164.13	150.85	138.49	126.96	116.19	106.12	96.69	87.85
1.5	207.84	191.42	176.21	162.08	148.94	136.71	125.29	114.63	104.67	95.33	86.58	78.36	70.63
1.6	174.02	160.05	147.05	134.94	123.65	113.10	103.23	93.98	85.31	77.17	69.51	62.31	55.52

Figure b-1 - EVA model with equity risk premium and risk free rate

Beta/ERP													
238.36	**0.0%**	**0.5%**	**1.0%**	**1.5%**	**2.0%**	**2.5%**	**3.0%**	**3.5%**	**4.0%**	**4.5%**	**5.0%**	**5.5%**	**6.0%**
0.1	3,501.20	3,342.83	3,195.56	3,058.28	2,930.05	2,810.01	2,697.45	2,591.69	2,492.17	2,398.37	2,309.83	2,226.14	2,146.92
0.2	3,501.20	3,195.56	2,930.05	2,697.45	2,492.17	2,309.83	2,146.92	2,000.62	1,868.60	1,748.97	1,640.15	1,540.81	1,449.82
0.3	3,501.20	3,058.28	2,697.45	2,398.37	2,146.92	1,932.95	1,748.97	1,589.37	1,449.82	1,326.98	1,218.17	1,121.27	1,034.55
0.4	3,501.20	2,930.05	2,492.17	2,146.92	1,868.60	1,640.15	1,449.82	1,289.26	1,152.36	1,034.55	932.36	843.08	764.59
0.5	3,501.20	2,810.01	2,309.83	1,932.95	1,640.15	1,407.16	1,218.17	1,062.42	932.36	822.52	728.86	648.32	578.54
0.6	3,501.20	2,697.45	2,146.92	1,748.97	1,449.82	1,218.17	1,034.55	886.25	764.59	663.50	578.54	506.47	444.81
0.7	3,501.20	2,591.69	2,000.62	1,589.37	1,289.26	1,062.42	886.25	746.45	633.56	541.07	464.33	400.00	345.56
0.8	3,501.20	2,492.17	1,868.60	1,449.82	1,152.36	932.36	764.59	633.56	529.23	444.81	375.58	318.14	270.00
0.9	3,501.20	2,398.37	1,748.97	1,326.98	1,034.55	822.52	663.50	541.07	444.81	367.81	305.32	253.95	211.28
1	3,501.20	2,309.83	1,640.15	1,218.17	932.36	728.86	578.54	464.33	375.58	305.32	248.82	202.78	164.82
1.1	3,501.20	2,226.14	1,540.81	1,121.27	843.08	648.32	506.47	400.00	318.14	253.95	202.78	161.40	127.51
1.2	3,501.20	2,146.92	1,449.82	1,034.55	764.59	578.54	444.81	345.56	270.00	211.28	164.82	127.51	97.15
1.3	3,501.20	2,071.85	1,366.25	956.60	695.21	517.70	391.67	299.11	229.30	175.48	133.20	99.46	72.14
1.4	3,501.20	2,000.62	1,289.26	886.25	633.56	464.33	345.56	259.19	194.61	145.18	106.61	75.99	51.32
1.5	3,501.20	1,932.95	1,218.17	822.52	578.54	417.27	305.32	224.66	164.82	119.34	84.06	56.19	33.82
1.6	3,501.20	1,868.60	1,152.36	764.59	529.23	375.58	270.00	194.61	139.09	97.15	64.78	39.33	18.98

Appendix d - Impact on cost of equity

Figure d-1 – Risk free rate beta

Beta/Risk Free 6.12%	0.0%	0.2%	0.4%	0.6%	0.8%	1.0%	1.2%	1.4%	1.6%	1.8%	2.0%	2.2%	2.4%
0.10	0.43%	0.63%	0.83%	1.03%	1.23%	1.43%	1.63%	1.83%	2.03%	2.23%	2.43%	2.63%	2.83%
0.20	0.86%	1.06%	1.26%	1.46%	1.66%	1.86%	2.06%	2.26%	2.46%	2.66%	2.86%	3.06%	3.26%
0.30	1.29%	1.49%	1.69%	1.89%	2.09%	2.29%	2.49%	2.69%	2.89%	3.09%	3.29%	3.49%	3.69%
0.40	1.72%	1.92%	2.12%	2.32%	2.52%	2.72%	2.92%	3.12%	3.32%	3.52%	3.72%	3.92%	4.12%
0.50	2.15%	2.35%	2.55%	2.75%	2.95%	3.15%	3.35%	3.55%	3.75%	3.95%	4.15%	4.35%	4.55%
0.60	2.58%	2.78%	2.98%	3.18%	3.38%	3.58%	3.78%	3.98%	4.18%	4.38%	4.58%	4.78%	4.98%
0.70	3.01%	3.21%	3.41%	3.61%	3.81%	4.01%	4.21%	4.41%	4.61%	4.81%	5.01%	5.21%	5.41%
0.80	3.44%	3.64%	3.84%	4.04%	4.24%	4.44%	4.64%	4.84%	5.04%	5.24%	5.44%	5.64%	5.84%
0.90	3.87%	4.07%	4.27%	4.47%	4.67%	4.87%	5.07%	5.27%	5.47%	5.67%	5.87%	6.07%	6.27%
1.00	4.30%	4.50%	4.70%	4.90%	5.10%	5.30%	5.50%	5.70%	5.90%	6.10%	6.30%	6.50%	6.70%
1.10	4.73%	4.93%	5.13%	5.33%	5.53%	5.73%	5.93%	6.13%	6.33%	6.53%	6.73%	6.93%	7.13%
1.20	5.16%	5.36%	5.56%	5.76%	5.96%	6.16%	6.36%	6.56%	6.76%	6.96%	7.16%	7.36%	7.56%
1.30	5.59%	5.79%	5.99%	6.19%	6.39%	6.59%	6.79%	6.99%	7.19%	7.39%	7.59%	7.79%	7.99%
1.40	6.02%	6.22%	6.42%	6.62%	6.82%	7.02%	7.22%	7.42%	7.62%	7.82%	8.02%	8.22%	8.42%
1.50	6.45%	6.65%	6.85%	7.05%	7.25%	7.45%	7.65%	7.85%	8.05%	8.25%	8.45%	8.65%	8.85%
1.60	6.88%	7.08%	7.28%	7.48%	7.68%	7.88%	8.08%	8.28%	8.48%	8.68%	8.88%	9.08%	9.28%

Figure d-2 - Equity risk premium and risk free rate

Risk Free/ERP 6.12%	0%	0.50%	1.00%	1.50%	2.00%	2.50%	3.00%	3.50%	4.00%	4.50%	5.00%	5.50%	6.00%
0.2%	0.20%	0.79%	1.39%	1.98%	2.57%	3.17%	3.76%	4.36%	4.95%	5.54%	6.14%	6.73%	7.32%
0.4%	0.40%	0.99%	1.59%	2.18%	2.77%	3.37%	3.96%	4.56%	5.15%	5.74%	6.34%	6.93%	7.52%
0.6%	0.60%	1.19%	1.79%	2.38%	2.97%	3.57%	4.16%	4.76%	5.35%	5.94%	6.54%	7.13%	7.72%
0.8%	0.80%	1.39%	1.99%	2.58%	3.17%	3.77%	4.36%	4.96%	5.55%	6.14%	6.74%	7.33%	7.92%
1.0%	1.00%	1.59%	2.19%	2.78%	3.37%	3.97%	4.56%	5.16%	5.75%	6.34%	6.94%	7.53%	8.12%
1.2%	1.20%	1.79%	2.39%	2.98%	3.57%	4.17%	4.76%	5.36%	5.95%	6.54%	7.14%	7.73%	8.32%
1.4%	1.40%	1.99%	2.59%	3.18%	3.77%	4.37%	4.96%	5.56%	6.15%	6.74%	7.34%	7.93%	8.52%
1.6%	1.60%	2.19%	2.79%	3.38%	3.97%	4.57%	5.16%	5.76%	6.35%	6.94%	7.54%	8.13%	8.72%
1.8%	1.80%	2.39%	2.99%	3.58%	4.17%	4.77%	5.36%	5.96%	6.55%	7.14%	7.74%	8.33%	8.92%
2.0%	2.00%	2.59%	3.19%	3.78%	4.37%	4.97%	5.56%	6.16%	6.75%	7.34%	7.94%	8.53%	9.12%
2.2%	2.20%	2.79%	3.39%	3.98%	4.57%	5.17%	5.76%	6.36%	6.95%	7.54%	8.14%	8.73%	9.32%
2.4%	2.40%	2.99%	3.59%	4.18%	4.77%	5.37%	5.96%	6.56%	7.15%	7.74%	8.34%	8.93%	9.52%
2.6%	2.60%	3.19%	3.79%	4.38%	4.97%	5.57%	6.16%	6.76%	7.35%	7.94%	8.54%	9.13%	9.72%
2.8%	2.80%	3.39%	3.99%	4.58%	5.17%	5.77%	6.36%	6.96%	7.55%	8.14%	8.74%	9.33%	9.92%
3.0%	3.00%	3.59%	4.19%	4.78%	5.37%	5.97%	6.56%	7.16%	7.75%	8.34%	8.94%	9.53%	10.12%
3.2%	3.20%	3.79%	4.39%	4.98%	5.57%	6.17%	6.76%	7.36%	7.95%	8.54%	9.14%	9.73%	10.32%

Figure d-0-1 – Equity risk premium and beta

Beta/ERP						Equity Risk Premium							
6.12%	0.0%	0.2%	0.7%	1.2%	1.7%	2.2%	2.7%	3.2%	3.7%	4.2%	4.7%	5.2%	5.7%
0.10	1.01%	1.03%	1.08%	1.13%	1.18%	1.23%	1.28%	1.33%	1.38%	1.43%	1.48%	1.53%	1.58%
0.20	1.01%	1.05%	1.15%	1.25%	1.35%	1.45%	1.55%	1.65%	1.75%	1.85%	1.95%	2.05%	2.15%
0.30	1.01%	1.07%	1.22%	1.37%	1.52%	1.67%	1.82%	1.97%	2.12%	2.27%	2.42%	2.57%	2.72%
0.40	1.01%	1.09%	1.29%	1.49%	1.69%	1.89%	2.09%	2.29%	2.49%	2.69%	2.89%	3.09%	3.29%
0.50	1.01%	1.11%	1.36%	1.61%	1.86%	2.11%	2.36%	2.61%	2.86%	3.11%	3.36%	3.61%	3.86%
0.60	1.01%	1.13%	1.43%	1.73%	2.03%	2.33%	2.63%	2.93%	3.23%	3.53%	3.83%	4.13%	4.43%
0.70	1.01%	1.15%	1.50%	1.85%	2.20%	2.55%	2.90%	3.25%	3.60%	3.95%	4.30%	4.65%	5.00%
0.80	1.01%	1.17%	1.57%	1.97%	2.37%	2.77%	3.17%	3.57%	3.97%	4.37%	4.77%	5.17%	5.57%
0.90	1.01%	1.19%	1.64%	2.09%	2.54%	2.99%	3.44%	3.89%	4.34%	4.79%	5.24%	5.69%	6.14%
1.00	1.01%	1.21%	1.71%	2.21%	2.71%	3.21%	3.71%	4.21%	4.71%	5.21%	5.71%	6.21%	6.71%
1.10	1.01%	1.23%	1.78%	2.33%	2.88%	3.43%	3.98%	4.53%	5.08%	5.63%	6.18%	6.73%	7.28%
1.20	1.01%	1.25%	1.85%	2.45%	3.05%	3.65%	4.25%	4.85%	5.45%	6.05%	6.65%	7.25%	7.85%
1.30	1.01%	1.27%	1.92%	2.57%	3.22%	3.87%	4.52%	5.17%	5.82%	6.47%	7.12%	7.77%	8.42%
1.40	1.01%	1.29%	1.99%	2.69%	3.39%	4.09%	4.79%	5.49%	6.19%	6.89%	7.59%	8.29%	8.99%
1.50	1.01%	1.31%	2.06%	2.81%	3.56%	4.31%	5.06%	5.81%	6.56%	7.31%	8.06%	8.81%	9.56%
1.60	1.01%	1.33%	2.13%	2.93%	3.73%	4.53%	5.33%	6.13%	6.93%	7.73%	8.53%	9.33%	10.13%

Appendix e – Share price difference between DCF and EVA

Figure e-1

Discounted Cash Flow Model			Economic Value Added		
Discount rate	Share price	Change in 0.5% WACC	Discount rate	Share price	Change in 0.5% WACC
0.5%	6,514.32	-3,463.73	0.5%	10,227.53	-5,726.24
1.0%	3,050.59	-1,150.24	1.0%	4,501.29	-1,857.68
1.5%	1,900.36	-571.97	1.5%	2,643.61	-895.40
2.0%	1,328.38	-340.75	2.0%	1,748.21	-513.87
2.5%	987.63	-225.21	2.5%	1,234.34	-325.58
3.0%	762.42	-159.24	3.0%	908.76	-219.83
3.5%	603.18	-118.06	3.5%	688.94	-155.14
4.0%	485.12	-90.64	4.0%	533.80	-113.11
4.5%	394.48	-71.49	4.5%	420.68	-84.56
5.0%	322.99	-57.59	5.0%	336.13	-64.47
5.5%	265.40	-47.19	5.5%	271.66	-49.95
6.0%	218.22	-39.21	6.0%	221.71	-39.22
6.5%	179.00	-32.97	6.5%	182.48	-31.15
7.0%	146.04	-27.99	7.0%	151.33	-24.99
7.5%	118.04	-23.97	7.5%	126.34	-20.22
8.0%	94.08	-20.67	8.0%	106.12	-16.49
8.5%	73.41	-17.93	8.5%	89.63	-13.54
9.0%	55.48	-15.64	9.0%	76.10	-11.19
9.5%	39.84	-13.71	9.5%	64.91	-9.30
10.0%	26.13		10.0%	55.61	
	Average	-168.03		Average	-535.36