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Tesla Inc.

An Equity Valuation

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Tesla Inc., An Equity Valuation

By

Julie Catarino

Abstract

The purpose of this dissertation is to determine the value of one Tesla, Inc. share as of 31 December 2018. An analysis of the automotive and energy generation and storage industry is presented, together with a detailed analysis of Tesla's business and financial performance.

For Tesla's valuation purposes, the financial items are forecasted for a period of 10 years, i.e. from 2018 to 2027. In order to determine Tesla's value, it is used the DCF approach, with the WACC as the discount rate. Additionally, the multiples method is also prepared as a complementary valuation to DCF.

Based on the DCF approach, the achieved Tesla's price target is $229.95, with a downside of 27.62% when comparing to the actual market share price $317.69, on 31 December 2018. Therefore, it is considered that Tesla is overvalued.

In addition, a sensitivity analysis was completed to variations on WACC, terminal growth rate and total operating costs.

Finally, the estimated Tesla's share price is compared to the valuation done by J.P.Morgan, which recommended price target is $216 on 31 December 2018. To conclude, both valuations yield to a sell recommendation.

Keywords: Tesla, Automotive Industry, Renewable Energy Industry, Equity Valuation, Firm Valuation, Discounted Cash Flow Method, Multiples Method, Sensitivity Analysis.

Tesla Inc., Uma Avaliação da Empresa

Por

Julie Catarino

Resumo

O objetivo da presente dissertação é determinar o valor de uma ação da Tesla, Inc. a 31 de dezembro de 2018. É apresentada uma análise da indústria automóvel, produção e armazenamento de energia, juntamente com uma análise detalhada do negócio e do desempenho financeiro da Tesla.

Para fins de avaliação da Tesla, são efetuadas previsões das contas financeiras para um período 10 anos, i.e., de 2018 a 2027. Por forma a determinar o valor da Tesla é usado o método DCF com WACC como a taxa de desconto. Adicionalmente, também é usado o método dos múltiplos, como um método de avaliação complementar do DCF.

Com base no modelo DCF, o preço *target* estimado da Tesla é $229.95, o qual representa um valor de 27.62% abaixo do preço de mercado da ação $317.69, a 31 de dezembro de 2018. Neste sentido, considera-se que a Tesla está sobrevalorizada.

Adicionalmente, uma análise de sensibilidade é efetuada relativamente às variações na taxa WACC, na taxa de crescimento a longo prazo e nos custos operacionais.

Por fim, o preço estimado da Tesla é comparado com a avaliação feita pela J.P.Morgan, que recomendou um preço *target* de $216 a 31 de dezembro de 2018. Concluindo, ambas as avaliações recomendam uma decisão de venda.

Palavras-Chave: Tesla, Indústria Automóvel, Indústria das Energias Renováveis, Avaliação do Capital Próprio, Avaliação da Empresa, Fluxo de Caixa Descontados, Avaliação por Múltiplos, Análise de Sensibilidade.

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Table of Contents

List of Figures

List of Tables

1. Introduction

The automotive industry is witnessing a major transformation from the production of only conventional gasoline-powered vehicles to electric vehicles as well. Tesla, Inc does not fit in any traditional model and, in fact, nowadays, is the only car brand that sells only fully electric vehicles. The company has created an impact on the automotive sector. Some years ago, Tesla was the only car manufacturer that produced and sold fully electric vehicles, however, currently, several established companies are offering this type of car to the market.

Based on the above, the aim of this dissertation is to enlarge the study of Tesla and find its value as of 31 December 2018. Therefore, the research question is defined as follows:

What is the value of one Tesla, Inc. share?

Additionally, one of the main intentions of this dissertation is to infer whether Tesla's value is overvalued as commonly said between analysts.

For that purpose, a valuation overview and the most well-known and used valuations methods will be presented in the literature review chapter. Afterwards, an analysis of the industry and of the Company will be described, in order to understand the industry, the past and the potential future performance of Tesla.

Then, the dissertation will move on to a detailed forecast of Tesla's financial items, accompanied by the computation of Tesla's value, based on the DCF and Multiples method. In the following chapter, a sensitivity analysis is performed to determine the impact of the change of a key assumption on Tesla's valuation.

In the end, the valuation of Tesla will be compared with the valuation performed by the investment bank J.P.Morgan, and the stock recommendation decisions will be identified.

2. Literature Review

The aim of this chapter is to give a general understanding of the most well-known valuation approaches before presenting the equity valuation performed on Tesla. This chapter starts with a valuation overview.

Afterwards, the DCF approach and Relative valuation are described. Other relevant valuation methods, namely the Adjusted Present Value (APV), Dividend Discount Model (DDM) and Economic Value Added (EVA), are described in Appendix 1. For each valuation approach described in this section, it is explained their main assumptions, in what conditions the method is more suitable to be used and some limitations.

Finally, this chapter will close with defining the valuation methods used to value one share of Tesla.

2.1. Valuation Overview

Over the past years, the importance of valuation has been increasing. The knowledge of the mechanism of enterprise valuation has become a prerequisite for enterprise's resource-allocation decision, as it identifies the value of each decision (Luherman, 1997). As a matter of fact, the process of valuing an enterprise and its business units enables to identify sources of economic value creation and destruction within the enterprise (Fernández, 2007). Therefore, companies take advantage of this knowledge to make wiser strategic and operating decisions, such as what businesses to own and how to make trade-offs between growth and returns on invested capital (Koller, Goedhart, & Wessels, 2015).

Damodaran (2002) claims that information related to a specific enterprise may affect an entire sector or expectations for all enterprises in the market. As a result, the majority agrees that when valuing an enterprise, a detailed analysis of the enterprise should be done, regarding market position, investment policy, profitability, finance structure, management characteristics and quality of human capital, as well as, an analysis of the industry, competitors, economic environment, macroeconomic and politics.

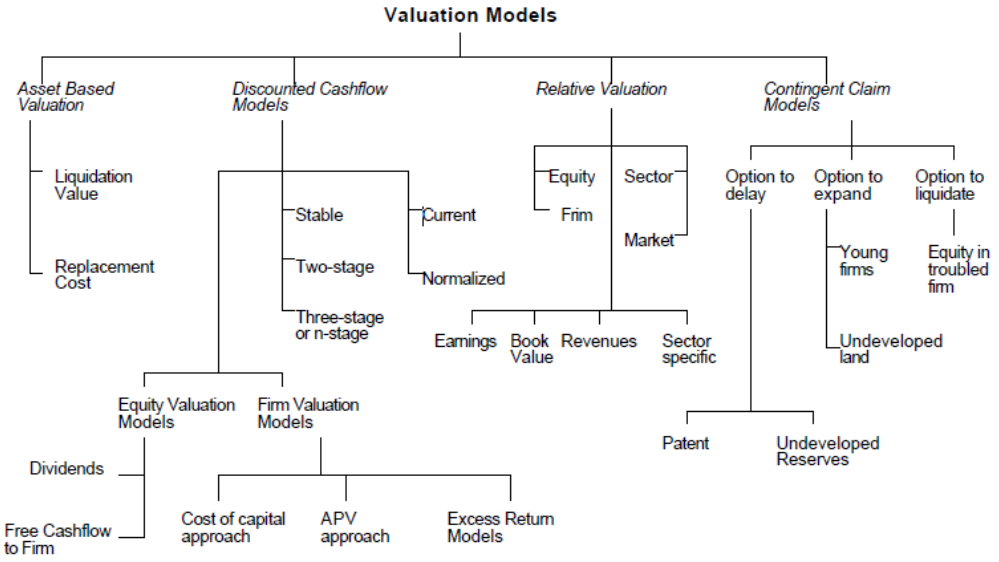
However, regardless of how deep the analysis can be, there will always be uncertainty about the final enterprise value reached as assumptions concerning the enterprise and economy future are made throughout the valuation (Damodaran, 2002). Additionally, Fernàdez (2004) explains

that the most common and uncommon errors in enterprise valuation are related to discount rate calculations, valuing the enterprise riskiness, forecasting cash flows, residual value, among others.

Currently, there are several approaches to valuation (figure 1). According to Young, Sullivan, Nokhasteh, & Holt (1999, p.4), "most popular valuation approaches are different ways of expressing the same underlying model" and, therefore, as the authors show in their paper, these referred approaches are mathematically equivalent under certain assumptions.

Although over the years there were several valuation frameworks studied and implemented, there is no single framework expected to be consistently more reliable than others (Young et al., 1999). According to Damodaran (2006), there are four main approaches to company valuation: Asset Based Valuation, Discounted Cash Flow, Relative Valuation and Contingent Claim Valuation, as shown in figure 1.

Figure 1: Valuation Models



Source: Damodaran, 2002, Chapter 35 p.3

In general, the younger the company is, the more difficult is the company valuation, because of the lack of historical data and uncertainty about fundamental factors and their forecasts (Festel, Wuermseher & Cattaneo, 2013). According to Damodaran (2011), younger companies are more difficult to value because are dependent upon future growths, are more exposed to failure and there is uncertainty about when the company will become a stable growth company.

While some young growth companies may generate revenues, their earnings may continue to be negative during a couple of years (Damodaran, 2009). Therefore, Damodaran (2009) argues that if a company have negative earnings early in the life cycle, there is the possibility that

relative valuation such as price earnings ratios are not applicable. Moreover, Petersen and Plenborg (2012) affirm that companies that share these characteristics are not directly comparable with well-established companies, regardless of belonging to the same industry.

2.2. Discounted Cash Flow Valuation

Koller et al. (2015, p.313) state that the Discounted Cash Flow (DCF) model is the "most accurate and flexible method for valuing projects, divisions, and companies". However, the author highlights the risk of making mistakes due to errors in estimating relevant components used for valuing a company, as there is a large number of assumptions and projections made throughout the valuation.

Also, Gup and Thomas (2010) suggest that this referred model is the most sophisticated because it is based on cash flows resulting from the balance sheet statement and the income statement, takes into consideration the opportunity cost of capital and, finally, it reflects the period in which the cash flows are explicitly forecast.

On the contrary, Luehrman (1997) pointed out that the DCF model that uses the weighted average cost of capital (WAAC) approach is obsolete. Additionally, the author states that the WAAC approach is still used just because is seen as standard over the years and not because it performs the best.

The DCF approach determines the asset value by forecasting the future cash flow of an asset, discounting it at an appropriate rate (r) that reflects the risk of that asset (Damodaran, 2006; Luehrman, 1997). Indeed, the enterprise is worth for its capacity to generate value and, the enterprise value arises mainly from the capacity to generate future cash flows. The general formula of the DCF approach is the following equation (Fernández, 2007):

$$\text{Asset's Value} = \frac{\mathrm{CF_1}}{(1+\mathrm{r})} + \frac{\mathrm{CF_2}}{(1+\mathrm{r})^2} + \frac{\mathrm{CF_2}}{(1+\mathrm{r})^3} + \cdots + \frac{\mathrm{CF_{n+}\,RV_n}}{(1+\mathrm{r})^n}$$

$$\mathrm{RV} = \frac{\mathrm{CF_n}(1+\mathrm{g})}{(\mathrm{r}-\mathrm{g})}$$

In the DCF approach, the cash flows (CF) are forecasted under numerous assumptions about how the company will perform during the explicit period and by forecasting financials items related to the company's operation, which are responsible for cash flow creation (Fernández, 2007). According to analyst, the explicit period of forecasts is commonly 5 or 10 years,

depending on when a company enters into a stable growth stage. The above formula is also composed by the residual value (RV), usually called as terminal value (TV), where it is assumed a cash flow with a specific constant growth rate (g) after year n. Young et al. (1999) affirm that the TV is the most important element in a company's valuation.

There are two approaches to use cash flow for valuation, namely, Free Cash Flow to Equity (FCFE) approach and the Free Cash Flow to the Firm (FCFF).

FCFE

According to Fernández (2007, p.16), the FCFE is the "cash flow remaining available in the company after covering fixed asset investments and working capital requirements and after paying the financial charges and repaying the corresponding part of the debt's principal (in the event that there exists debt)". Therefore, the succeeding equation determines the FCFE:

$$\text{FCFE} = \text{FCFF} - \text{Interest Expenses} * (1 - \text{tax rate}) - \text{Pincipal Repayments} + \text{Net Debt Issues}$$

FCFF

Fernández (2007, p.14) defines the FCFF as being the "cash flow generated by operations, without taking into account borrowing (financial debt), after tax". Furthermore, it is the cash flow available to the company after considering the operation expenses, fixed asset investment and working capital investments. The general equaition of FCFF can be written as follows (Damodaran, 2006):

$$\text{FCFF} = \text{EBIT} * (1 - \text{tax rate}) + \text{Depreciations} - \text{Capital Expenditure} - \Delta\text{Working Capital}$$

In contrast to FCFE, which cash flows are after interest payments and debt cash flows, the cash flow demonstrated on the equation above, are before debt payments and after taxes and reinvestment needs (Damodaran, 2006). Therefore, tax benefits of debt are not included on FCFF. However, the discount rate, WAAC, incorporates this benefit as it uses the after-tax cost of debt (Damodaran, 2002).

The enterprise value can be determined as the present value of the projected FCFF and of the TV, discounted at WACC, as shown on the following equation (Damodaran (2006):

$$\text{Entreprise Value} = \sum_{t=1}^{t=n} \frac{\text{FCFF}_t}{(1 + \text{WAAC})^t} + \frac{\frac{\text{FCFF}_{n+1}}{(\text{WAAC} - g_n)}}{(1 + \text{WAAC})^n}$$

The main difference between FCFF and FCFE arise primarily from cash flows used as starting point, cash flow from operations or cash flows for shareholders, respectively, as well as cash flows associated with debt (Damodaran, 2002).

2.2.1. Terminal value

The terminal value is the company's expected cash flows value beyond the explicit period (Mauboussin, 2006). Damodaran (2009) states that the TV represents a large proportion of the enterprise value, and it is even larger when it is concerned a young company. Young et al. (1999) affirm that the TV is the most important element in a company's valuation.

The TV assumes that cash flows, discount rate and growth are constants over time (Young et al., 1999). As a result, assumptions about when a company will reach a steady stage and with what growth rate may have a huge impact on the enterprise value Mauboussin (2006). Therefore, terminal value should be determined when the company has achieved "low revenues growth and stable operating margins" (Koller et al., 2015, p.216).

The following equation is commonly referred by authors in order to determine the TV:

$$\text{Terminal Value} = \frac{\text{FCFF}_n(1+g)}{(\text{WAAC}-g)}$$

Although capital expenditures may be lower than depreciations, the TV should not be estimated with capital expenditures lower than depreciations, as it is not consistent to use a FCF with these values (Fernández, 2004). Furthermore, the expected growth rate should be lower than the economy growth rate (Koller et al., 2015).

2.2.2. Weighted Average Cost of Capital

The WAAC, also known as cost of capital, is defined by Young et al. (1999, p.14) as the "after tax cost of debt multiplied by the proportion of debt plus the cost of equity multiplied by the proportion of equity":

$$\text{WACC} = R_d * (1-T) * \frac{D}{V} + R_e * \frac{E}{V}$$

WACC reflects equity and debt investors' expected return for the time value of money and the risk related to an asset (Petersen & Plenborg, 2012). In case of default, debt holders have the

priority and, therefore, cost of debt should be lower than the cost of equity. Consequently. the required rate of return must be calculated separately for the two types of investors.

According to Damodaran (2006), the cost of capital should reflect only the company's operating risk, as the cash flows used are cash flows from the operating assets. The free cash flow is determined in after-tax term, therefore, WACC should be estimated after corporate taxes (Koller et al., 2010).

Although there are many valuations that use the marginal tax rate, Fernández (2004) affirms that the tax rate that should be used to calculate the WAAC is the effective tax rate. On the contrary, Pinto et al. (2010, p.77) defend that "cost of capital based on the marginal tax rate usually better reflects a company's future costs in raising funds" and, also, the effective tax rate may reflect nonrecurring items.

2.2.3. Cost of Debt

Cost of debt represents the effective cost that a company has to pay for its current debt (Damodaran, 2002). Damodaran (2002) explains that the cost of debt is estimated by three variables. First, the riskless rate, which increases the cost of borrowing money, as that rate increases. Second, the company's default risk, that is, the probability of a company defaulting. Likewise, as the default risk increases, the cost of debt shall also increase. Last, the tax benefit arising from the contracted debt and paying interest, which allows the after-tax cost to be lower than the pre-tax cost of debt. Damodaran (2002, p.39) states that "since interest is tax deductible, the after-tax cost of debt is a function of the tax rate".

Therefore, the cost of debt should be calculated on an after-tax basis, as regards companies without tax exemption with market values rather than book values:

$$\text{After tax cost of debt} = \text{Pre} - \text{tax cost of debt} * (1 - \text{tax rate})$$

Regarding publicly traded companies, Koller et al. (2010) suggest to calculate the Yield to Maturity (YTM) from the bond's price and promised cash flows, to calculate the cost of capital. However, most of the companies do not trade on a regular basis and, therefore, one should estimate a default spread based on the company's debt rating (Damodaran, 2002).

Finally, in case the company is not rated, Damodaran (2002) propose to determine the interest coverage ratio, as follows:

$$\text{Interest coverage ration} = \frac{\text{EBIT}}{\text{Interest Expenses}}$$

Damodaran (2002) affirm that with this computation it is possible to associate to a company rating and, therefore, to obtain a default spread (appendix 16). Consequently, the cost of debt can be estimated by:

$$\text{Cost of debt} = \text{Risk} - \text{free rate} + \text{default spread}$$

2.2.4. Cost of Equity

Over the past years, the capital asset pricing model (CAPM) developed by Sharpe (1964) and Lintner (1965) and, built on the model of portfolio choice presented by Markowitz (1959), is still the most commonly accepted asset pricing model and widely used for calculating the cost of capital.

The cost of equity is the rate of return investors require on an equity investment in a firm (Damodaran. 2002). In order to calculate the cost of equity (expected return (E(R)), it must be estimated the risk-free rate of return (Rf), the difference between the expected return on a market portfolio (Rm) and the Rf, defined as the market risk premium and, the market risk of a particular asset (β) (Koller et al., 2010). Therefore, based on CAPM, the general equation to estimate the cost of equity is the following:

$$\text{E(R)} = \text{Rf} + \beta\,[\text{E(Rm)} - Rf]$$

Fama and French (2004, p.25) believe that the CAPM is commonly used in applications because it "offers powerful and intuitively pleasing predictions about how to measure risk and the relation between expected return and risk". However, CAPM can reveal weaknesses in the theory or in its empirical implementation, thus making the majority analysis done with the referred model invalid. Despite recent critiques, when developing a company valuation based on WACC, the CAPM remains to be the most used model for estimating the cost of equity.

2.2.5. Risk-free rate

Fernández (2004) defines the risk-free rate as the rate that can be obtained at the time when the cost of equity is determined by using risk-free government bonds at the same time.

According to Damodaran (2009, p.165) a rate to be considered as risk-free needs to meet two conditions: "first that no risk of default is associated with its cash flows and second that there can be no reinvestment risk in the investment".

Most empirical researchers suggest to use the long-term government treasury bonds to calculate the risk-free rate, in developed economies (e.g. 10-year zero coupon government bonds). Since government bonds are usually issued with different maturities, it should be used a government default-free bond with the same maturity as the maturity of the discounted cash flows (Koller et al., 2010).

2.2.6. Beta

Zenner et al. (2008, p.1) define beta as a "calibration factor that is higher (lower) that one if the asset has a systematic, or non-diversifiable, risk that is higher (lower) than the market's risk". Therefore, beta represents the market risk of a particular asset. Moreover, it is different across companies and varies according to the period that is was calculated (Damodaran, 2001).

Koller et al. (2010) state that, according to CAMP, the expected return of a stock depends on beta, which represents the correlation between that stock's value and the market. The authors suggest estimating beta by using regression.

According to Damodaran (2002), beta can be estimated by using a regression of the historical stock returns of an investment against the historical market, as follows:

$$R_j = \alpha + \beta * Rm$$

The slope of the regression corresponds to the beta of the stock.

One component needed to calculate the cost of equity is the levered beta (also known as equity beta). The additional risk arising from the fact that the company has debt, in other words, from the leverage, can be expressed as follows:

$$\beta_L = \beta_U * [1 + (1 - T) * \frac{D}{E}]$$

Damodaran (1994) assumes that debt carries no market risk, thus, having a debt beta of zero. Conversely, Fernández (2004, p.5) states that the correct relation between the levered beta (β_L) and the unlevered beta (β_U) is:

$$\beta_L = \beta_U + (\beta_U - \beta_{D)} * \frac{D * (1 - T)}{E}$$

2.2.7. Market Risk Premium

The Market Risk Premium (MRP) is defined as the "incremental premium required by investors relative to a risk-free asset" (Zenner et al., 2008, p.1). CAMP proposes an adjustment on the equation commonly used[1] through the adjustment on the MRP with beta:

$$\text{Expected Market Portfolio Return} = \text{Rf} + \beta * \text{MRP}$$

Additionally, Zenner et al. (2008) propose several methods to estimate MRP, namely, historical average realized return, dividend discount model, constant Sharpe ratio method, bond-market implied risk premium, dividend yield method and Survey evidence. On their paper, they concluded that MRP falls most likely between 5% and 7%.

Koller et al. (2010) classify as the appropriate premium range between 4.5% and 5.5%. Further, Bruner et al. (1998) research indicated that most of the best-practice companies use a MRP of 6% or lower despite the fact that many authors and analysts use higher premiums.

Although the numerous researches done, and papers published, there is no consensus among practitioners regarding the best model to estimate this component.

2.3. Relative Valuation

Relative valuation seeks to estimate the value of a company through the comparison with other companies, which are similar to that company, in other words, the value of an asset is compared to that of another similar or comparable asset (Damodaran, 2002).

Goedhart et al. (2005, p.1) state that "a properly executed multiples analysis can make financial forecasts more accurate". The authors suggest that the DCF valuation become more accurate as well as their forecasts with a detailed analysis comparing the multiples of the company valued with those of the comparable companies. Similarly, Fernández (2001) states that relative valuation can be useful in a second stage of the valuation, by reviewing the completed valuation and multiples, as well as, by carefully identifying differences between the company that is being analysed and the comparable companies.

[1] Expected market portfolio return = Risk-free rate of return + market risk premium

As per Goehart et al. (2005), analysts should not use industry average because companies in the same industry as the company valued may have significantly different growth rates, return on invested capital (ROIC) and capital structures.

According to Goehart et al. (2005), there are four basic principles in order to properly value a company based on multiples. It is essential to find a peer group and use peers with similar ROIC and growth forecasts. Besides that, another basic principle is the use of forward-looking multiples. As a matter of fact, both the principles of valuation and the empirical evidence suggest that forward-looking method should be followed as it is more accurate than historical multiples (Goehart et al., 2005 and Koller et. al., 2010). Finally, the use enterprise-value multiple, as well as the adjustment of this multiple for nonoperating items also represent a basic principle.

According to Fernandez (2001), the most commonly used price and enterprise value multiples are the following:

Figure 2: Valuation Multiples

P/E, PER	Price earnings ratio
P/CE	Price to cash earnings
P/S	Price to sales
P/LFCF	Price to levered free cash flow
P/BV	Price to book value
P/AV	Price to asset value
P/Customer	Price to customer
P/units	Price to units

P/output	Price to output
EV/EBITDA	Enterprise value to EBITDA
EV/S	Enterprise value to sales
EV/FCF	Enterprise value to unlevered free cash flow
EV/BV	Enterprise value to book value
PEG	Price earnings (PER) to growth
EV/EG	Enterprise value to EBITDA growth

Source: Fernandez 2001, p.3

Damodaran (2002) reveals that almost 90% of equity research valuations use relative valuations. In fact, according to Lie and Lie (2002), valuations performed with multiples are often preferred rather than with DCF approach, since it is difficult to estimate cash flows and to find the adequate discount rate. Besides, multiples are simple and easy to work with (Damodaran, 2002).

According to Damodaran (2006, p.650), a comparable company is "one with cash flows, growth potential, and risk similar to the firm being valued". In general, comparable companies belong to the same sector. However, this approach becomes harder when there are not enough companies in the same industry which share similar cash flows, growth and risk profiles (Damodaran, 2006). Goedhart et al. (2005) explain that in order to obtain the right companies, those have to have similar expectations regarding long-term growth and ROIC.

Overall, when choosing the peer group there are several components that should be analysed, such as, business area, size, growth, debt to equity and profitability. However, it is often difficult to find a true peer group.

According to Koller et al., (2010) enterprise value to EBITDA is wildly used and perceived as the best multiples for comparing valuations across companies. Price-to-Earnings (P/E) cannot be calculated for companies with zero or negative earnings (Pinto et al., 2010). About EV-to-Sales multiple, this multiple is useful for companies with "volatile earnings volatile earnings or other situations when earnings fail to represent long-term operating potential" (Koller et al., 2010, p.327).

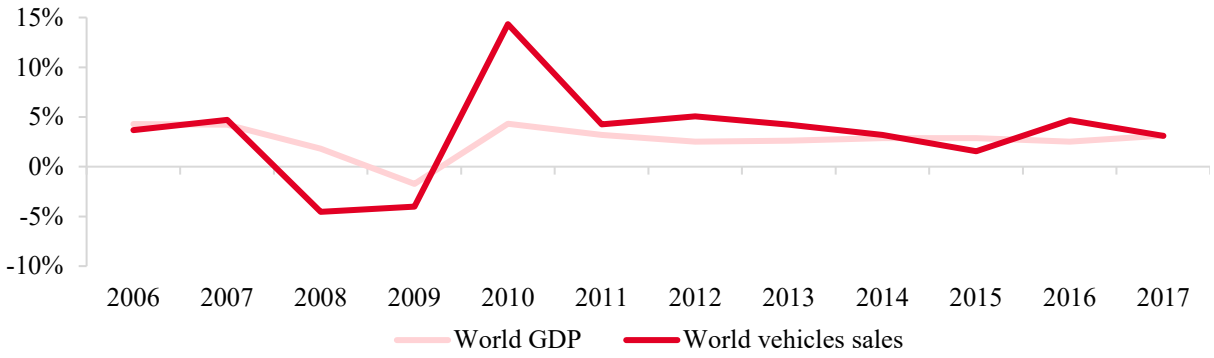
Conclusion

In this thesis, the valuation methods used to value one share of Tesla are the DCF and Multiples method. The DCF approach was chosen as it is widely used on equity valuations and for its accuracy and flexibility. Although the DCF model does not discriminate the tax shields advantages or the distress costs, it provides a more complete analysis regarding the company's operations. Lastly, Multiples method are used as a second stage of Tesla equity valuation in order to verify the DCF results and to compare with its peer group.

3. Industry Overview

The automotive industry has been growing, at least, from the last 8 years (figure 3). Over the years, more and more cars are sold worldwide. Due to a growing economy, environmental consciousness, increase of oil prices and government incentives to electric cars, the automotive industry is witnessing a major transformation – the development of battery electric (BEVs) and plug-in hybrid electric (PHEVs) vehicles. However, conventional cars are expected to continue to dominate in the coming years.

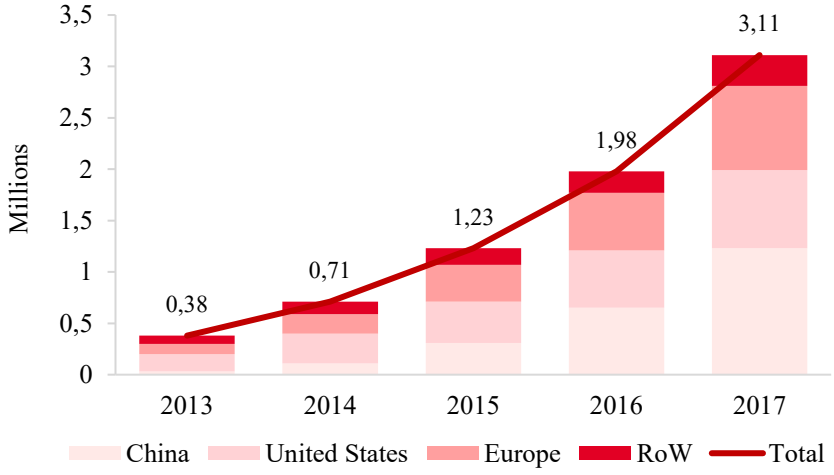
Figure 3: World GDP and vehicles sales growth



Source: World Bank, OICA and own calculations

Nowadays, most automakers are producing and developing fully electric cars (EVs) and consumers are becoming more open-minded to this type of cars. In 2017, more than 3 million electric vehicles were sold worldwide, a growth beyond 55% from the previous year (figure 4). From 2016 to 2017, sales of EVs rose 90%, 36% and 57% in China, in the US and in Europe, respectively.

Figure 4: Number of electric vehicles from 2013 to 2017 (in millions)



Source: International Energy Agency (IEA) and compiled by the author

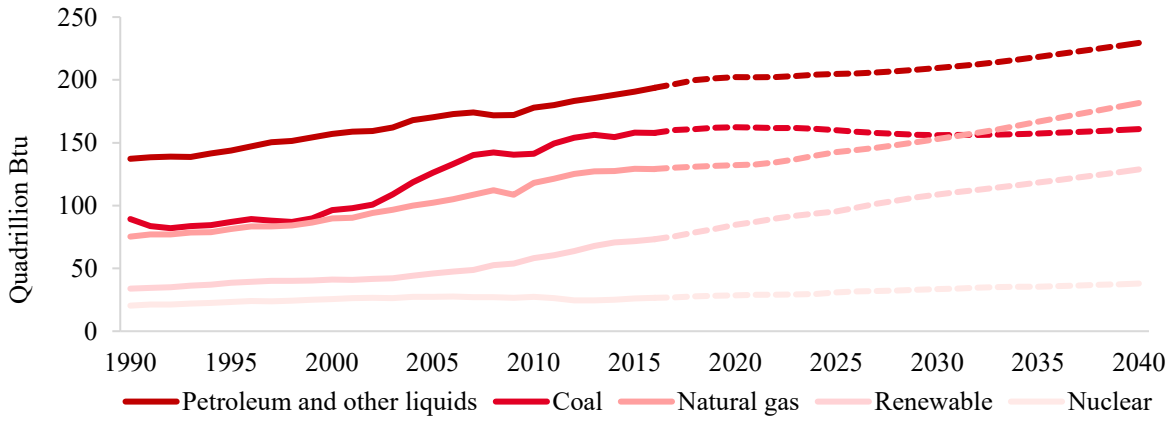
Despite significant growth in sales, the EVs only stood for 0.2% of the market share in 2017. BEVs and PHEVs sales are expected to rise in market share from 1% in 2017 to 20% in 2030.

The demand in China has been significantly increasing in the past years and was the largest market for electric vehicles in 2017, with 1.23 million EVs. In 2017, China represented around 40% of all global EVs sales. In addition, the Chinese government believes that by 2025 7million EVs may be sold per year. Electric vehicle market in the US is expected to grow from 0.83% to 7.08% by 2025 of total cars sales in that country. Concerning Europe, there are more than one million EVs in the European roads and Norway is the leader country with a higher number of electric cars.

Government incentives for the purchase of EVs are becoming more frequent in several countries around the world. This consist of, for instance, tax exemptions on the cars, free tolls and parking, subsidies. In the US, a tax credit of $7.500 is applied on the acquisition of an electric car, if certain conditions are met. Accordingly, these government measures are encouraging the purchase of EVs, which contributes to the constant growth of sales of those cars.

The world consumption of energy has been generally increasing for all fuels over the past years. In addition, the referred consumption is expected to continue to increase, on average, for Petroleum, coal, natural gas, renewable and nuclear (figure 5). Globally, renewable energy is more and more used as a fuel and, it is estimated that, from 2017 to 2040, its consumption will rise by 70%. In addition, renewable energy will account for 17% of all world consumption whereas petroleum and other liquids may account for 31% in 2040.

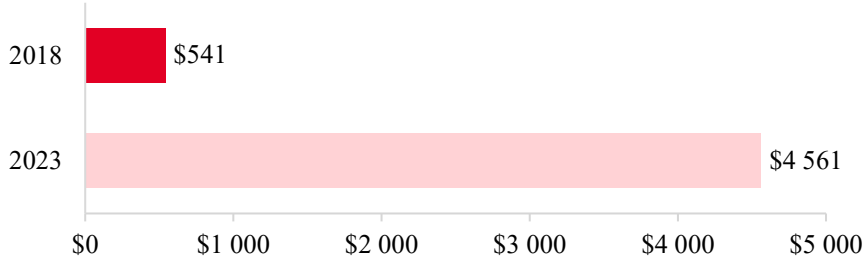
Figure 5: World energy consumption from 1990 to 2040



Source: US Energy Information Administration (IEO2018)

Renewable energy was the source of energy that had the highest growth in 2017 (3.3%). With that increase, the energy storage deployments are increasing as well. According to GTM Research and Energy Storage Association (ESA), energy storage deployments are expected to grow from 2018 to 2019 by 154%, in the US. It is estimated that the market size of energy storage will represent 4,561 million of dollars in 2023 (figure 6). Additionally, this growth is mainly due to the increase in "residential deployments as customers continue to exhibit increased interest in self-consumption and resilience" (GTM Research and ESA, September 2018).

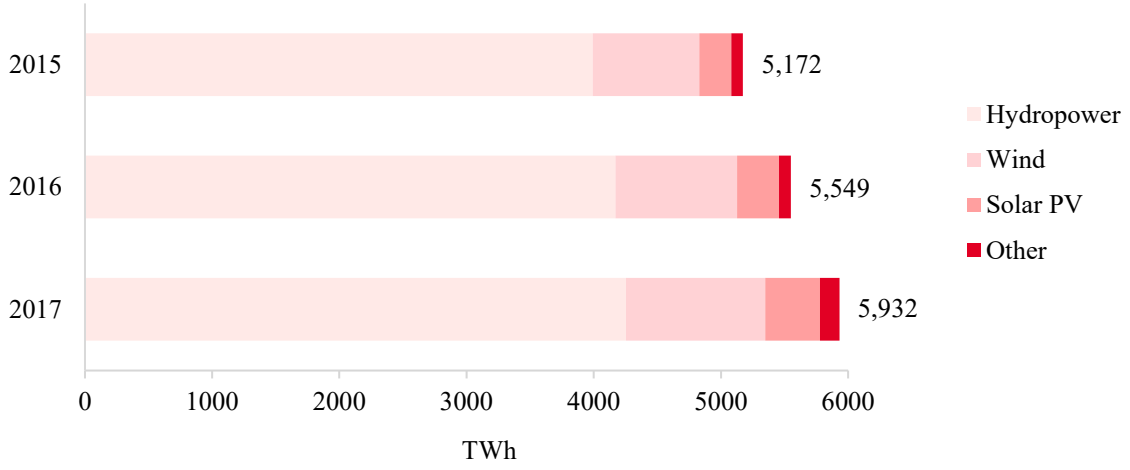
Figure 6: Annual market size of energy storage in the US (in $millions)



Source: GTM Research and ESA

Together with the rise of consumption of renewable energy, the energy generation has been growing in absolute number for all type of sources and, overall, in 2016 and 2017 they saw a rise of 7.3% and 6.9%, respectively (figure 7). The Solar Photovoltaic (Solar PV) was the source that had greater growth, with 32% higher generation in 2017, in relation to the previous year. In fact, the Solar PV may be considered as the most affordable source of electricity generation in many countries.

Figure 7: Renewables' electricity generation by source from 2015 to 2017 (in TWh)



Source: IEA and compiled by the author

4. Tesla Inc. Overview

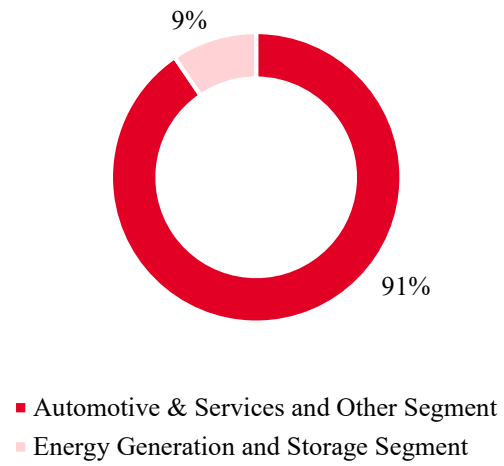
4.1. Introduction

In 2003, Matin Eberhard and Mar Tapenning founded Tesla, Inc., formerly Tesla Motors, Inc., an American automotive company that designs, develop, manufacture and sells high-end fully electric vehicles as well as powertrain components for electric vehicles. Elon Musk, the current CEO and Co-founder, said in one of his presentations in 2016 that "it is very important to accelerate transition to sustainable transport" and this is the main goal of Tesla.

Nowadays, Tesla is a well-known and recognized worldwide brand. The Company was considered the 4th largest automotive company by market value and the largest in the US, in early 2017, despite having just sold around 76,000 cars during 2016.

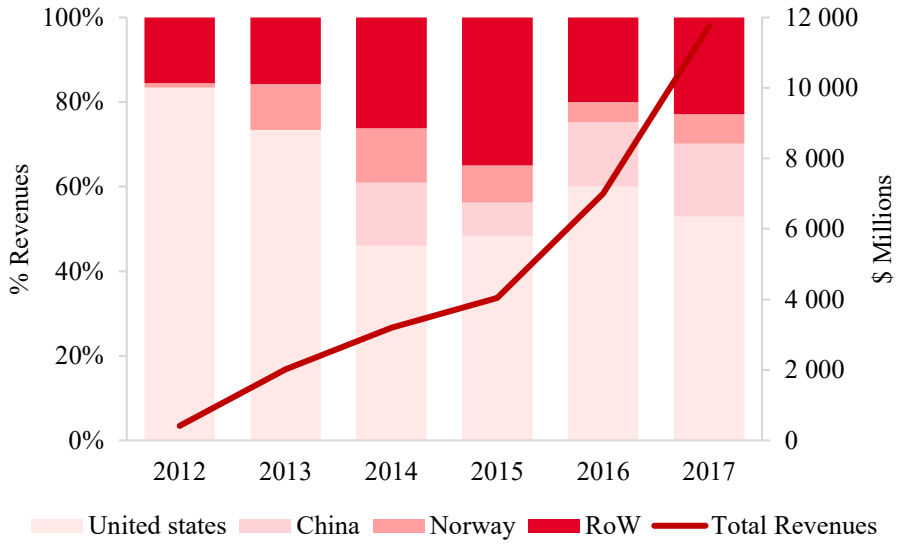
Today, Tesla produces and sells not only electric vehicles but also infinitely scalable clean energy generation and storage products in the US and abroad. Thereby, the Company operates in two segments, the automotive sector and energy generation and storage sector. Tesla operates in the energy sector since 2014, and this stood for 0.13% and 0.36% of the total sales in 2014 and 2015, respectively. During 2017, the first segment represented around 91% of the total revenues and energy generation and storage sector about 9% (figure 8).

Figure 8: % Revenues by business segment in 2017



Currently, the US, China and Norway are the main regions where Tesla's revenues arise. Figure 9 shows the distribution of total revenue across each geographic area between 2012 and 2017, as well as the total revenues performance in millions of US dollars.

Figure 9: % Revenues by geographic area in 2017



Source: Tesla Annual Report and compiled by the author

In 2013, Tesla expanded its Supercharger network to China, as that country was an important part of Tesla's growth strategy and was/is perceived to be one of their largest market within a few years.

Along the years, the US continues to play an import role in Tesla's revenues. In 2017, the US represented about 53% of the total revenues, where China represented around 17% (figure 9). Additionally, Norway, the most significant European country for Tesla, stood for 7% of the total revenues and, the remaining 23%, were distributed in the rest of the world (RoW).

4.2. Automotive Sector

In 2008, Tesla launched the first car, the Tesla Roadster, which was the first fully electric sport car to be sold to the market and costed more than one hundred thousand US dollars. Additionally, at the end of 2012, Tesla stopped the production of this car and sold around 2,450 cars in over 30 countries between 2008 and 2012, mostly in North America and Europe.

By 2009, Tesla announced the second model, the Model S, which is considered the first luxury electric car and a prototype was presented in a public exhibition. However, only after 3 years of Model S announcement, the model was available to its customers (in 2012). At the end of that year, Tesla delivered around 2,650 Model S and had 15,000 customer reservations.

When Tesla started to sell the Model S, during 2012, it unveiled a new model, the Model X sport utility vehicle (SUV), which started to be sold later in 2015. Additionally, Tesla started

to build supercharges through California, in order to enable its customers to make long distant travels. The supercharges are considered as the fasted and most sophisticated charging network in the world. By November 2018, there were 1,375 supercharger stations with 11,414 supercharges around the world.

In early 2013, Tesla was struggling as did not have enough capital to continue Model S production and meet its customer expectations. Furthermore, the Company almost filed for bankruptcy, however, in the first quarter of 2013, Tesla registered profits for the first time since went public and after 10 years of its incorporation.

The goal of Elon Musk with Model 3 is to reach massive production. Only one week after Tesla started to accept pre-orders for Model 3, they received more than 350 thousand pre-orders, which amounts to approximately 14 billion dollars in expected sales. However, the production of this model was delayed and Tesla initial target of production - producing more than five thousand cars per week by the end of 2017 - was not achieved. Consequently, the Company just delivered 1,542 Model 3 cars in 2017. According to Tesla third quarter report, Tesla was producing around 4,300 Model 3 cars per week and delivered 56,065 Model 3. In total, Tesla delivered nearly 70,000 cars in the US in the third quarter. The Company started to accept orders for Model 3 both in Europe and in China during 2018 and will start to deliver it to customers during 2019.

Indeed, Tesla has arranged with Shanghai's government to allow them to build a Gigafactory 3 in Shanghai, which will be fully owned by Tesla. The EVs market had been increasing significantly in Chine and is by far the largest in the world. Tesla aims to achieve a production of 500,000 vehicles in that factory in 2020/21, which should only meet the Chinese demand.

Further to these four models, in November 2017, Tesla unveiled an upcoming semi-trailer fully electric, the Semi Truck. Additionally, in the same presentation, Elon Musk announced the second generation of Roadster as well. The first is expected to be built in full-scale production in 2019 and delivered to customers by 2020. The latter will be the fastest luxury car ever made and should be available in the market also in 2020. However, it is expected that those productions may perhaps be delayed.

4.3. Energy generation and storage Sector

Another sector where Tesla is operating is the energy generation and storage sector with the aim of creating an entire sustainable energy ecosystem. Tesla Energy was launched in 2015 and is becoming a leader in this sector. Additionally, Tesla acquired SolarCity in November 2016.

The Company manufactures and develop energy storage products for homes, commercial use and utilities sites, such as Powerwall, Powerpack and Solar Roof. The first is designed for residential use and was sold for the first time in 2013. This product is an important element for Tesla to achieve the major end goal of energy generation and storage at home. The second product is designed for both commercial and utility sites and was available to customers during 2014. These products generate renewable energy, store it and, afterwards, the energy stored can be consumed. Tesla has been developing a second generation of these systems. The last, Solar Roof, was revealed in 2016 and is conceived to complement and power homes and commercial sites. This solar energy system was installed for the first time in July 2017.

For the Model 3 production of scale and for Tesla energy products, Tesla needs a huge amount of lithium-ion batteries. In fact, Tesla aimed to be able to produce 500 thousand vehicles during 2018 and one million in 2020. This means that to reach these values, the Company would require the entire supply of lithium-ion batteries in the world. Therefore, in 2014, it was announced the plan to construct a giant factory able to produce batteries - the Gigafactory.

Nowadays, Gigafactory is already supplying the so-called new generation batteries to cars, houses, companies and some cities. This factory will help to decrease significantly the batteries costs through innovative manufacturing, economies of scale and reduction of waste. The batteries packs' costs are expected to decrease through the years, as the production of batteries increases. Elon Musk believes that when the Gigafactory will be fully operational by 2020, the price of batteries packs used in its EVs will reduce by 30%. Furthermore, the reduction will allow Tesla to reduce its operational costs in the long-term and reduce its EVs price in the future.

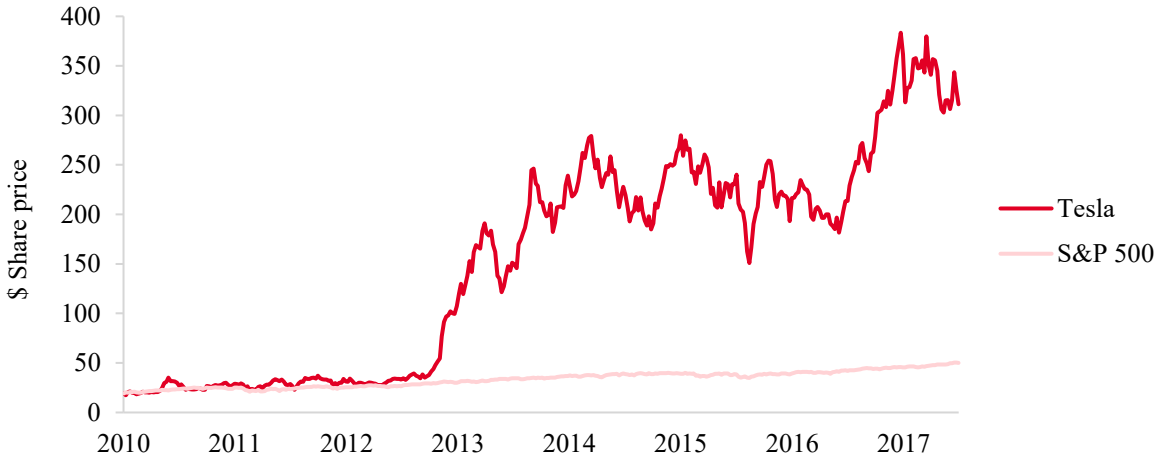
Moreover, one can say that the increasing price of fuel petrol and global warming, as well as the geopolitical factors, may be the reason for Tesla's long-term survival.

4.4. Tesla stock market performance

On 29 June 2010, Elon Musk, decided to take Tesla public under the ticker symbol "TSLA" on the Nasdaq Global Select Market, with a total amount of 13,300,000 Initial Public Offer (IPO) shares with a share price of $17. Therefore, the IPO allowed Tesla to raise over $225 million and was the first American automotive company that went public since Ford Motors IPO in 1956. Until today, Tesla is not paying dividends.

Figure 10 shows Tesla share price development since its IPO and the S&P500 share price development as if on Tesla IPO it would have the same adjusted closed price, i.e., $19.20, then it was considered the same changes of its historical price.

Figure 10: Tesla share price development and S&P500



Source: Thomson Reuters and own calculations

As per the above figure, one shall notice that, up to the beginning of 2013, Tesla share price tracked S&P500 index. However, afterwards, the two-path started to diverge significantly. As a matter of fact, Tesla registered profits for the first time in the first quarter of 2013, since its incorporation. One year later, Tesla's price had risen by approximately 460%, to $212.37. The stock price achieved a record high of $383, in June 2017.

Although Tesla has been reporting losses of millions of US dollars during the past years, its market capitalization exceeded that of Ford and General Motors in June 2017, corresponding to $60.3, $45.4 and $52.4 billion, respectively. The constant expansion and implemented strategies have made possible for Tesla to exceed the market expectations, which has resulted in a continuous market value increase.

5. Tesla Inc. Valuation

An equity valuation is conducted to answer the next question:

What is the value of one Tesla Inc. share?

Both DCF and Relative valuation methods will be used in order to value Tesla's price per share on 31 December 2018.

This chapter will start with the forecasting of financial items from Tesla's income statement and balance sheet. Further on, the FCFF will be calculated together with the chosen discount rate, WAAC. The succeeding section will concentrate on the calculation of the present value of FCFF and terminal value. All these estimations will consider some assumptions, which are discriminated below. Finally, this chapter will be concluded with a relative valuation.

5.1. Forecasting Income Statement

In this section, several accounting items from the income statement will be forecasted for the next 10 years, i.e. from 2018 to 2027. The financial items' forecasts are mainly based on the Company's past performance and assumptions regarding its future performance and of the automotive and energy industry. Nevertheless, a more detailed analysis of those financial items and their forecasts is presented below.

Revenues

Tesla's total revenues are forecasted by taking into consideration each segment of revenue separately, as follows:

i) Automotive revenue

For the year 2018, only the last quarter of 2018 is necessary to forecast. The automotive revenues of the 2018 fourth quarter wer estimated based on the equivalent quarter of 2017 and the historical growth of the same quarter of the previous year, as follows:

$$\text{Rev}_{\text{fourth quarter2018}} = \text{Rev}_{\text{fourth quarter2017}} * (1 + \text{historical growth})$$

The main restriction for the number of vehicles delivered by Tesla is the production capacity, as such, being the key driver for forecasted sales growth. Therefore, automotive revenue for the remaining years (2019-2027) is predicted based on the limits of production capacity and,

consequently, the expected number of vehicles delivered and on the average sale price of each model.

Elon Musk aimed to produce 500,000 vehicles during 2018. However, by analysing Tesla's current situation of its production capacity and past events, it is expected that the production will be higher than 500,000 cars manufactured only by 2023 (appendix 5).

Moreover, it is expected that Tesla will produce higher volumes of Model 3 than Model S and X together. Therefore, it was estimated that the number of Model 3 fabricated will exceed the other models. In addition, Model 3 became the main priority for Tesla, in order to reach mass production and economies of scale in the near future with the purpose of having lower costs of production and higher market share in the EVs market.

It is estimated that that **Model S** car sales from 2019 to 2023 will follow the same CAGR of the past 3 years, i.e. 4.18%, and then the units sold will growth at the same rate as the forecasted US GDP growth (2%).

Model X was introduced to the market in late 2015. As a result, from 2015 to 2016 the number of deliveries increased exponentially from 212 to 25,335 (10631%) and from 2016 to 2017 increased by 84% (table 1). Thus, it was estimated that Model X shall increase in percentage more than Model S, with a YoY growth of 10% until the beginning of the steady period (2023). As from 2023, the increase in car deliveries will become more stable and converge to 2% over the steady period.

Table 1: Tesla production and deliveries in units by model and CAGR

	2013	2014	2015	2016	2017	1,2,3Q 2018	CAGR
Production						*(without the 4Q 2018)*	
Model S	23 187	35 125	50 835	56 022	53 092	38 793	23.01%
Model X			260	27 900	45 250	37 599	1219.24%
Model 3					2 685	91 583	-
Total production	**23 187**	**35 125**	**51 095**	**83 922**	**101 027**	**167 975**	
Deliveries							
Model S	22 477	31 655	50 446	50 950	54 754	37 130	24.93%
Model X			212	25 335	46 558	34 630	1381.94%
Model 3					1 772	82 687	-
Total deliveries	**22 477**	**31 655**	**50 658**	**76 285**	**103 084**	**154 447**	

As illustrated in table 1, Tesla ended the year of 2017 producing 2,685 **Model 3** and by the end of 2018 third-quarter Tesla reported 82,687 deliveries and a production amounting to 91,583. In fact, when Model 3 was launched, 400,000 orders were made. It is important to note that,

today, Tesla is not able to meet demand due to its production limitations, but this is expected to be diminished with its Gigafactories.

The electric vehicle market is increasing significantly year by year. The global number of EVs sales is expected to grow from 2018 to 2024 at a CAGR of 23.9%, from 9.4 million sales in 2017 to 51.5 million sales in 2024. Additionally, the CAGR of Model S deliveries from 2013 to 2017 corresponds to 24.93% (table 2). As per the above, as from 2019, the Model 3 production was forecasted based on the average of the two mentioned growth rates (24.42%). As from 2023, the growth rate will smoothly decrease over the years to 5%.

Overall, the main goal of Tesla is to create an EVs priced to compete with its gasoline-powered equivalents and that would be considered the first mass market of EVs in the world. For that reason, in 2027, the Model 3 will account for 87% of automotive revenues (appendix 5).

The average sale price was calculated by considering the years 2013 and 2014, as in those years Tesla only sold Model S. By knowing the number of cars sold and its base price in the referred years, the average sale price and its margin was found (table 2).

Table 2: Model S average sale price and its margin in 2013 and 2014

	2013	2014
Automotive revenues	$1 921 877 000	$2 874 448 000
Model S units sold	22 477	31 655
Average sale price	**$85 504.16**	**$90 805**
Model S base price	$62 400	$62 400
% Margin	27%	31%
Average of % margin		**29%**

Source: 2013 and 2014 Tesla Annual Reports and own calculations

It is assumed that the average sale price of each model in 2019 will have the same average price margin as the one calculated in table 2, as represented in table 3.

Table 3: Average sale price of Model S, X and 3 in 2019

	Base Price	Average Sale Price
Model S	$74 500	$96 105
Model X	$79 500	$102 555
Model 3	$35 000	$44 699

Source: Tesla's website and own calculations

In 10 years from now, it is expected that the market share of EVs will be higher and the growth rate of YoY will not have abnormal values as current revenues as well as car production and sales have been reaching in the previous years. Also, the decrease in battery costs will allow

the company to decrease its vehicles prices to reach more competitive prices and attain a broader target of customers.

Regardless of the expected inflation of 2% and the brand awareness of Tesla, it is forecasted that the increase of competition from well-stablished companies and the reduction of production costs will drive Tesla to decrease its prices until the end of the explicit period.

To sum up, the automotive revenue was estimated based on car deliveries (appendix 5) and the average sale price of each of Tesla model currently available on the marker (apendix 6). Table 4 represents the historical and forecast of the automotive revenues from 2013 to 2027.

Table 4: Automotive revenue by model from 2013 to 2027 (dollars in millions)

	2013	2014	2015	2016	2017
Automotive revenues	1 922	2 874	3 432	5 589	8 535
% Growth	*398%*	*50%*	*19%*	*63%*	*53%*

	2018E	2019E	2020E	2021E	2022E	2023E	2024E	2025E	2026E	2027E
Model S		5 166	5 383	5 608	5 842	5 899	5 957	6 016	6 075	6 134
Model X		5 395	5 934	6 527	7 180	7 677	8 208	8 614	8 869	8 956
Model 3		7 872	9 696	11 943	14 710	17 391	19 699	21 338	22 181	23 057
Automotive revenues	**14 895**	**18 433**	**21 013**	**24 078**	**27 733**	**30 967**	**33 864**	**35 967**	**37 124**	**38 147**

ii) Automotive leasing revenue

Tesla only started to obtain this type of revenue as from 2014. As previously stated, the last quarter of 2018 is estimated based on the following equation:

$$\text{Rev}_{\text{fourth quarter2018}} = \text{Rev}_{\text{fourth quarter2017}} * (1 + \text{historical growth})$$

Automotive leasing revenue is related to vehicles sold and, consequently, with the automotive revenue, which, indeed, the correlation between those accounting items is about 99%. Therefore, as from 2019, the automotive leasing revenue is forecasted in function of automotive revenue growth, representing 7% of automotive revenue since 2018.

Table 5: Automotive leasing revenue from 2014 to 2027 (dollars in millions)

	2013	2014	2015	2016	2017
Automotive leasing	-	133	309	762	1 107
% Growth			*133%*	*146%*	*45%*

	2018E	2019E	2020E	2021E	2022E	2023E	2024E	2025E	2026E	2027E
Automotive leasing	971	1 202	1 370	1 570	1 808	2 019	2 208	2 345	2 420	2 487

iii) Energy generation and storage revenue

Tesla started to generate and storage energy in 2014 and in 3 years it represents already about 9.5% of total revenues. This type of revenue has been following abnormal growth rates since Tesla has entered into that market. Additionally, the increase in revenue is mainly due to the acquisition of SolarCity in November 2016. According to the market expansion and the increase of this method of generating energy and store it, it is expected that those revenues will experience substantial growth.

As the first three quarters of 2018 are known, the last quarter of 2018 was estimated based on the equivalent quarter of 2017 and the historical growth of the same quarter of the previous year. However, for the remaining period, it was made several assumptions regarding the performance of energy generation and storage revenue.

In what concerns energy generation and storage revenue, the two sub-segments were forecasted separately. Forecasted energy generation revenue was based on the growth of the following variables[2] (appendix 8):

a) Energy consumption of solar photovoltaic generation;
b) Electricity price from solar photovoltaic generation;
c) World renewable energy consumption (excluding biofuels).

Energy generation revenue will represent almost 87% of total energy generation and storage revenue in 2018, while in 2027, will correspond to 52% of that revenue.

About energy storage, according to GTM research, in 2017, the USA market energy storage (600 MW) corresponds to 12% of the global market (6000 MW), i.e. around 9 times the USA market. In contrast, a Morgan Stanley report states that the global energy storage market will be 7 to 8 times bigger than the USA market. Based on the above, a more conservative approach was used to estimate the global energy storage market size, 7x of USA market size (appendix 9).

[2] The expected values for each year of the explicit period come from Annual Energy Outlook of 2018 research.

In line with the GTM research, it is assumed that total USA market size will increase at a compounded annual growth rate of 28.54%. Furthermore, it is expected that the USA market will represent 14% of the global energy storage market size (appendix 9). In 2016, Tesla captured slightly more than 32% of the whole US energy storage market and, it is assumed that Tesla US market share will remain constant until 2027. In agreement with Morgan Stanley report, it is expected that Tesla will capture 10% of the entire sector by the end of 2027 (appendix 10). The US is foreseen to correspond to 92% (RoW 8%) and 46% (RoW 54%) of Tesla energy storage revenue in 2018 and 2027, respectively.

Table 6 shows the energy generation and storage revenue forecasted, which represent a CAGR of approximately 19%, from 2018 to 2027.

Table 6: Energy generation and storage revenue between 2014 and 2027 (dollars in millions)

	2013	2014	2015	2016	2017
Energy generation and storage	-	4	14	181	1 116
% Growth			*244%*	*1153%*	*515%*

	2018E	2019E	2020E	2021E	2022E	2023E	2024E	2025E	2026E	2027E
Energy generation		2 555	3 360	3 849	4 040	4 153	4 266	4 612	5 001	5 340
Energy storage		379	757	1 085	1 313	1 916	2 307	2 722	3 162	3 627
Energy generation and storage	**1 860**	**2 933**	**4 118**	**4 934**	**5 353**	**6 069**	**6 574**	**7 334**	**8 162**	**8 967**

iv) Services and other revenue

Services and other revenues include primarily maintenance services, sales and used car sales. Once more, only the fourth quarter of 2018 was estimated. In 2018, this item accounted for 9% of total automotive revenue and fluctuated between 7% and 10% from 2015 to 2018. As a result, to forecast those revenues, a constant 9% weight of total automotive revenue is considered until the end of the explicit period.

Table 7: Services and other revenue from 2013 to 2027 (dollars in millions)

	2013	2014	2015	2016	2017
Services and other	92	187	291	468	1 001
% Growth	*232%*	*104%*	*55%*	*61%*	*114%*

	2018E	2019E	2020E	2021E	2022E	2023E	2024E	2025E	2026E	2027E
Services and other	1 890	2 932	3 413	3 993	4 692	5 334	5 899	6 306	6 524	6 730

Cost of revenues

According to Koller et al. (2010), the cost of revenue should be forecasted based on revenue. Indeed, the cost of revenues item is highly correlated with revenues, 0.999 between 2010 and 2017. Thereby, the cost of revenues is projected based on the annual change of the respective revenue and on the quarter change just for the year 2018, for example:

$$\text{Cost of revenues}_{\text{fourth quarter2018}} =$$

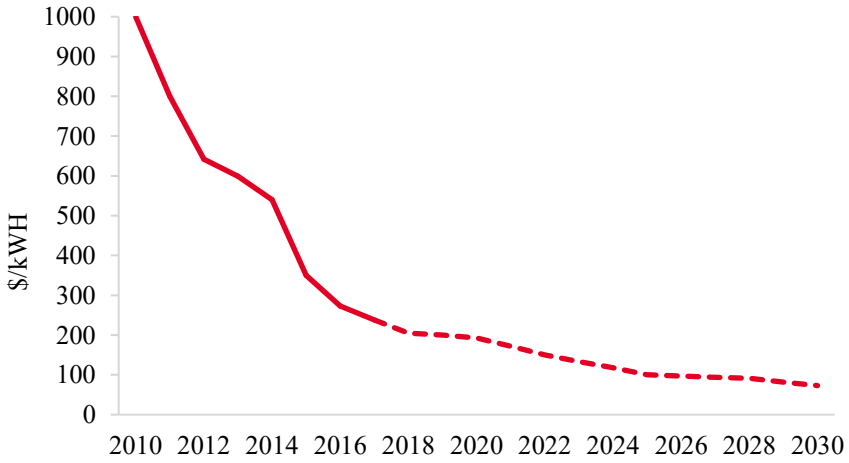
$$= \text{Cost of revenues}_{\text{fourth quarter2017}} * (1 + \%\ \text{quarter change in revenues}_{\text{fourth quarter2017}})$$

Nevertheless, concerning the services and other cost of revenues, the projections will be based on average of the percentage of services and other revenues of the last 5 years (2014-2018)

With respect to the automotive cost of revenue, other assumptions were considered on the basis of calculating their projections as from 2019. The battery packs for EVs were never so cheap as today. In 2010, the EVs battery packs cost around $1,000/kWh (figure 11). Currently, it is estimated that the Model 3 battery pack cost approximately $190/kWh.

Elon Musk aims to achieve a battery production cost of 100 kWh by 2020. However, a more conservative approach is applied to forecast the automotive cost of revenues. It is expected that by 2027 battery prices will drop to $94/kWh (figure 11). Nowadays, the worldwide average battery pack cost represents more than 40% of a vehicle total production cost. It is modelled that the referred cost will represent just 23% of total car production cost by 2027 (appendix 11).

Figure 11: Lithium-ion battery pack cost from 2010 to 2023



Source: BNEF and own calculations

Based on above, as from 2019, the forecasted automotive cost of revenues as from is based on revenues' growth and on the projected decrease of battery packs cost per kWh and the weight that those batteries represent on car cost (appendix 11).

Overall, the forecasted cost of revenues is represented below.

Table 8: Cost of revenue between 2013 and 2027 (dollars in millions)

	2013	2014	2015	2016	2017
Total cost of revenues	1 557	2 317	3 123	5 401	9 536

	2018E	2019E	2020E	2021E	2022E	2023E	2024E	2025E	2026E	2027E
Total cost of revenues	15 947	19 698	22 944	25 789	28 602	31 291	33 447	34 901	36 385	37 739

Operating expenses

Tesla expects that research and development expenses together with selling, general and administrative expenses will, in general, increase over the next years but decrease as a percentage of revenue due to its continuing effort to reduce these expenses with the improvement of operational efficiency. Additionally, Tesla has fired employees during 2017 (corresponding to almost 2% of the total amount of employees) and there are thoughts that Tesla will fire more people as they are cutting positions that are no longer essential.

Thereby, the forecasted R&D and SG&A were calculated based on the total change of revenues and are expected to decrease a percentage of revenue and meet the auto industry average figures[3]. To forecast the last quarter of 2018, the same approach was implemented as in cost of revenue.

Table 9: Operating expenses between 2013 and 2027 (dollars in millions)

	2013	2014	2015	2016	2017
R&D	232	465	718	834	1 378
SG&A	286	604	922	1 432	2 477
Operating expenses	**518**	**1 068**	**1 640**	**2 267**	**3 855**

	2018E	2019E	2020E	2021E	2022E	2023E	2024E	2025E	2026E	2027E
R&D	1 624	1 821	1 849	1 804	2 060	2 305	2 518	2 693	2 813	2 922
SG&A	3 417	4 099	4 518	4 884	5 201	5 401	5 440	5 330	5 055	5 251
Operating expenses	**5 041**	**5 919**	**6 367**	**6 688**	**7 261**	**7 706**	**7 958**	**8 024**	**7 867**	**8 173**

[3] Damodaran's website

Net interest expense

Tesla net interest expenses item includes interest income, interest expenses and other net expense/income. The last-mentioned accounting item highly depends on foreign exchange rates and the gains and losses arising from the fluctuation of those rates. As a result, this will not be considered on Tesla income statement forecast as it is extremely volatile and difficult to predict its behaviour.

Interest income and expenses should be a function of asset and liability that generates income and expenses, respectively (Koller et al., 2010). In this sense, interest income (expense) forecast was computed by taking into consideration the historical interest income (expense) and financial assets (debt) generating income (expenses).

Table 10: Net interest expenses from 2013 to 2027 (dollars in millions)

	2013	2014	2015	2016	2017
Int. income	0.2	1	2	9	20
Int. expense	(33)	(101)	(119)	(199)	(471)
Net int. expense	**(33)**	**(100)**	**(117)**	**(190)**	**(451)**

	2018E	2019E	2020E	2021E	2022E	2023E	2024E	2025E	2026E	2027E
Int. income	19	31	40	47	54	62	69	75	80	84
Int. expense	(683)	(1 070)	(1 306)	(1 494)	(1 656)	(1829)	(1 988)	(2 111)	(2 189)	(2 256)
Net int. expense	(664)	(1 039)	(1 266)	(1 447)	(1 602)	(1 767)	(1 199)	(2 036)	(2 109)	(2 172)

Provision for income taxes – effective tax rate

The US provided a tax relief when a company have a negative taxable income (tax losses carryforward). Although Tesla does not have a positive taxable income, the company is paying anyway taxes since it sells more and more cars outside of the US tax jurisdictions.

In general, to estimate income taxes is used the effective tax rate. Thus, to forecast the provision for income taxes, it was assumed the effective tax rate of 2017 (-1.43%) when the EBT is negative and the effective tax rate of the industry, 15,62%[4], when the forecasted EBT is positive.

[4] Thomson Reuters

5.2. Discounted Cash Flow Valuation

5.2.1. The Free Cash Flow to the Firm

To value one share of Tesla Inc. the FCFF approach will be followed by using the succeeding equation:

$$\text{FCFF} = \text{EBIT} * (1 - \text{tax rate}) + \text{Depreciations} - \text{Capital Expenditure} - \Delta\text{Working Capital}$$

Hence, the items from the above equation that were not estimated in the previous section, are estimated below for the explicit period, i.e. between 2018 and 2027, as well as the accounting items that should be calculated to estimate the respective items needed to compute the FCFF.

Depreciation and amortization

Koller et al. (2010) recommend that the forecast driver of depreciation should be the previous year net property, plant, and equipment (PP&E). In line with this reasoning, Tesla forecasted depreciation and amortization were estimated based on the historical average weight over PP&E between 2013 and 2017 (appendix 12).

PP&E

PP&E projections were computed in accordance with the annual change of revenues. Additionally, it was taken into account the historical average weigh of PP&E over revenue of the last five years.

Capital expenditures

CAPEX represents mainly the necessary expenditures to maintain business operations and support the company's growth. CAPEX reflects the increase in net PP&E added to depreciation. Therefore, CAPEX was computed based on the following equation:

$$\text{CAPEX}_t = \text{PP\&E}_t - \text{PP\&E}_{t-1} + \text{Depreciation}_t$$

Working Capital

To compute the FCFF it is necessary to compute the annual change in working capital (WC). The WC is obtained by the difference between the current assets and current liabilities. In addition, in order to calculate WC, not all current assets and liabilities from the Balance Sheet were considered (appendix 13).

Current assets

With the purpose to calculate WC, total current assets were estimated. As previously mentioned, not all current assets were estimated, as according to Pinto et al. (2010) "operating WC excludes any nonoperating items, such as excess cash, short-term debt and dividends payable". Thereby, the remaining items were forecasted as a percentage of revenue or as a percentage of cost of revenue, depending on the specific item (appendix 13).

Current liabilities

Given that WC does not include financial debt (Pinto et al., 2010), not all current liabilities items from Balance Sheet were computed. Most of those items are estimated based on the annual change of revenue but forecasted accounts payable is based on the change of cost of revenue (appendix 13).

Base on the above estimations, the free cash flow was calculated as follows:

Table 11: FCFF estimated from 2018 to 2027 (dollars in millions)

	2018E	2019E	2020E	2021E	2022E	2023E	2024E	2025E	2026E	2027E
+ EBIT*(1-tax rate)	(1 908)	(1 358)	(874)	343	1 625	2 471	3 696	5 111	5 820	6 097
+ Depreciation	1 908	2 425	2 842	3 278	3 742	4 188	4 573	4 892	5 109	5 308
CF from Operations	926	1 067	1 967	3 620	5 367	6 659	8 270	10 003	10 929	11 405
- CAPEX	5 207	6 032	5 751	6 323	6 986	7 300	4 573	4 892	5 109	5 307
- Change in WC	527	53	135	(90)	(187)	(183)	(230)	(329)	(15)	(17)
FCFF	**(5 733)**	**(5 018)**	**(3 918)**	**(2 612)**	**(1 432)**	**(457)**	**1 235**	**3 210**	**4 323**	**4 727**

5.2.2. Weighted Average Cost of Capital

The WAAC value was achieved with the following equation:

$$WACC = R_d * (1 - T) * \frac{D}{V} + R_e * \frac{E}{V}$$

For this purpose, the above components were estimated as described further on in this section.

5.2.2.1. Cost of Debt

Damodaran explains that the cost of debt can be estimated with the sum of the default spread rate associated with a specific company plus the risk-free rate. According to Moody's (2018), Tesla has a credit rating of B3, which, in fact, corresponds to the rating of the most recent bonds

issued. As per Damodaran (1989) that rating represents a default spread rate of 5.5% (appendix 16). The resulted cost of debt, before taxes, is 7.91%.

Additionally, the after-cost of debt should be obtained for WAAC purposes, therefore, the "tax benefit" is being deducted from the pre-tax cost of debt. Consequently, the estimated after-tax cost of debt rate is 6.67%.

5.2.2.2. Tax rate

As mentioned above, the tax rate considered in this dissertation is the effective tax rate of the industry. As a result, a tax rate of 15.62% was used to calculate the after-tax cost of debt and, consequently, for WAAC calculation.

5.2.2.3. Market Value of Debt

In order to estimate the price of one share of Tesla, the debt market value was calculated rather than the book value. Thus, to compute the Tesla market value of debt it was considered the following Damodaran's equation:

$$\text{Debt MV} = \text{Interest expenses} * \frac{1 - \frac{1}{(1 + k_d)^{\text{Maturity}}}}{k_d} + \frac{\text{Total debt}}{(1 + k_d)^{\text{Maturity}}}$$

The interest expenses and the total debt values used are the ones of 2017. Taking into consideration the cost of debt calculated above and that most bonds have on average a maturity of 6 years, the market value of debt found was $9,835,004 thousand.

5.2.2.4. Market Value of Equity

Herein, the market value was estimated as well. The equity market value is obtained by multiplying the number of shares outstanding by the share price. With respect to Tesla, on 31 December 2017, the number of shares outstanding and the share price was 165,758,000 and $311.64, respectively. Therefore, the obtained market capitalization of Tesla was $51,656,823 thousand.

5.2.2.5. Cost of Equity

As stated in the Literature Review, when WACC is the discount rate used for company valuation, CAPM is the most applied model to compute the cost of equity. Thereby, Tesla cost of equity estimation is given as: $k_e = Rf + \beta_L * MRP$

Risk-free rate

Regarding the risk-free rate, it was considered the US government bonds with the same maturity as the number of years of the forecast period, i.e 10 years. Additionally, the US is the main market where Tesla operates. Hence, we assume a risk-free rate equal to the US 10-year maturity government bond on 31 December 2017, 2.41%.

Levered Beta

Tesla levered beta was estimated and results from the regression of Tesla stock returns against market returns (Damodaran, 2002)[5]. Firstly, stock returns and market returns were calculated based on weekly historical prices from January 2014 to December 2018 of Tesla and S&P500 Index. Then, with those two variables, it was possible to calculate the slope of the regression - where Tesla stock return is the dependent variable and market return is the independent variable -, reaching a raw beta of 1.21 and an adjusted beta[6] of 1.14.

Market risk premium

It was assumed the weighted average of market risk premium of the main region of Tesla activity. In 2017, the US, China and Norway represented 53%, 17% and 7% of total revenues, respectively. The remaining part is entitled by Tesla as RoW, but the countries with higher weight, from 3% to 2%, are Canada, Germany, Netherlands and Switzerland. Given that, according to Damodaran database, those countries have the same MRP as the US, it was assumed that the MRP of the RoW is equivalent to the one of the US.

Hence, the MRP where Tesla operates were retrieved from Damodaran data (December 2017) and weighed based on the percentage of revenues by geographic area. The estimated MRP was 5.22%.

To conclude, the estimated WAAC is given in table 12.

Table 12: WAAC calculation

Cost of equity	8.36%
Cost of debt	7.91%
E/V	0.84
D/V	0.16
Tax rate	15.62%
WACC	**8.09%**

[5] Rj=α+β*Rm
[6] 2/3raw beta + 1/3market beta

5.2.3. Valuation

Tesla equity valuation is based on the DCF method and two major steps were taken. The first consisted on computing Tesla's enterprise value, which is the sum of the present values of all FCFF estimated above plus the present value of the TV, all discounted at the discount rate WAAC.

TV is perceived as the most important number in a company's valuation. As a matter of fact, the explicit period chosen has a significant impact on Tesla valuation, since when calculating the TV, the company should have already reached a stable and low sales growth as well as a stable operating margin. Tesla total revenues growth from 2025 to 2027 fall between 7% and 4%, approximately, and operating margin values are almost the same for the mentioned years herein. Additionally, the expected growth rate to estimate the TV should be lower than the inflation and the GDP growth together. It was assumed a perpetuity growth of 3.89%, which is the revenue growth rate of the last year of the explicit forecasted period.

To be able to verify if that growth is lower than the inflation plus the economy growth rate, it was assumed the weighted average of the forecasted inflation and GDP in 2027 of the main regions where Tesla operates. Those projected values were retrieved from OECD data base and the computed figure amounts to 4.67%. The TV was calculated by using the formula included in section 2.2.1 of the Literature Review.

In the second step, the net debt market value is deducted from the EV to get the market value of Tesla equity (table 13). Based on the table below, the equity value of Tesla is estimated at $38,116,267 thousand.

Table 13: DCF method – Tesla valuation

Enterprise Value	**$44 558 054**
Debt MV	$9 835 004
Cash and cash equivalent	$3 393 216
Net Debt	**$6 411 788**
Equity Value	**$38 116 267**
# Shares	165 758
Price per Share	**$229.95**

Expressed in thousands of dollars, except for number of shares and share price

To conclude, the estimated target price per share of Tesla is $229.95, on 31 December 2018. According to Thomson Reuters, the actual adjusted market share price as of the same date was $317.69.

5.3. Relative Valuation

Although the DCF approach is seen as the most accurate and flexible method by the majority of analysts, relative valuation brings value to the company valuation as it helps to verify the accuracy of cash flows forecasts and to understand mismatches between the company valued and the comparable ones. Therefore, a relative valuation on Tesla is performed further to a DCF analysis.

5.3.1. Peer Group

For relative valuation purposes, companies with similar characteristics and comparable ones, i.e. a peer group, should be found and selected. In general, it is difficult to find a true peer group because companies might be similar to each other but not comparable.

Firstly, in order to find an appropriate peer group, it was selected a larger peer group composed by automotive companies which sell electric cars. The referred group is mostly formed by companies that Tesla considers as its main competitors and based on information released by Reuters about Tesla's peers. Secondly, for each of those companies, the main financial information was retrieved from their annual reports and from Reuters. Then, certain performance, leverage and operating ratios were calculated. Thirdly, the peer group of Tesla was obtained based on the information gathered concerning each company, namely, the industry where they operate, their growth, return and risk. With those financial items, the companies were ranked by taking into consideration the range difference between each company's items and Tesla's items.

Finally, it was computed how many times a company was in the top 4. Consequently, the companies with higher frequency are the selected peers (highlighted), as follows:

Table 14: Tesla's peer group selection

Company name	#	Revenues growth	Market Cap.	EBITDA margin	ROE	D/E	ROIC	Beta
Tesla Inc.		**68.0%**	**51 609**	**0.03%**	**-0.53**	**2.43**	**-0.09**	**0.98**
Audi AG	1	3.4%	37 447	15.7%	0.12	0.02	0.09	0.42
Bayerische Motoren Werke AG	0	6.8%	68 538	19.7%	0.15	3.47	0.07	1.16
Daimler AG	4	7.2%	75 756	12.2%	0.14	2.01	0.07	1.18
Fiat Chrysler Automobiles NV	1	-0.1%	22 902	11.3%	0.14	0.73	0.07	1.36
Ford Motor Co	4	3.3%	49 091	9.1%	0.22	4.42	0.05	0.94
General Motors Co	4	-2.4%	60 050	15.9%	0.22	2.69	0.06	1.12
Nissan Motor Co Ltd.	3	6.6%	38 766	13.3%	0.14	1.62	0.07	0.94
Renault SA	3	16.9%	29 191	11.7%	0.15	1.53	0.13	1.24
Toyota Motor Corporation	4	7.7%	95 191	12.7%	0.11	1.11	0.05	0.95
Volkswagen AG	2	6.2%	100 011	17.7%	0.09	1.27	0.05	1.40
Volvo AB	2	10.5%	37 802	14.1%	0.19	1.22	0.09	1.41

Source: companies' annual reports, Reuters and own calculations

5.3.2. Multiples

After selecting the most appropriate peer group of Tesla, it is important to choose the most suitable multiples according to its financial performance.

The PER and EV/EBITDA multiples are the most used ones. However, PER will not be used, since Tesla has negative earnings. In contrast, the EV/Revenue multiple is useful for companies like Tesla which earnings tend not to represent the operational potential in a long-term point of view. In this way, the EV/EBITDA and EV/Revenue multiples will be used for estimating Tesla's value and are forward-looking multiples rather than historical ones.

It should be bear in mind the financial position and abnormal growth of Tesla, and as such, in addition to the 1year forward multiple, it was also considered the estimated EBIDTA and revenue in 2023, when it is predicted that Tesla will be more stable and in order to reflect the impact and potential profit arising from Tesla's car models, which multiples will be called as 2023 forward multiples.

Having chosen the multiples of the comparable companies, the average of the peer group for each multiple was computed and applied to Tesla's financials to estimate its enterprise value. With respect to 2023 forward multiples, the EV of Tesla obtained was actualized to 2018 at the discount factor.

Afterwards, the net debt was deducted from the EV to obtain the equity value and, then, Tesla's price per share was estimated, as it can be seen in table 15.

Table 15: Tesla's price per share based on Peers

	1Y EV/Revenue	1Y EV/EBITDA
Tesla Inc	**2.72**	**35.53**
Daimler AG	1.02	6.80
Ford Motor Co	0.95	10.88
General Motors Co	0.88	6.44
Toyota Motor Corporation	1.18	8.39
Average Peers	**1.01**	**8.13**
Tesla's Price per share	**$103.96**	**$54.06**
	2023 EV/Revenue	**2023 EV/EBITDA**
Tesla's Price per share	**$147.36**	**$223.33**

Source: Reuters and own calculations

It is notable the difference between Tesla's 1Y EV/Revenue and 1Y EV/EBITDA multiples, 2.72x and 35.53x, compared to the average peers' multiples, 1.01x and 8.13x, respectively. Given that Tesla has been growing substantially in the last past years and until 2017 has reported negative EBITDA, the 2023 forward multiples will be chosen as they reflect better Tesla's value.

As a result, the estimated Tesla's price per share in 2018 is $147.36 and $223.33, with 2023 EV/Revenue and 2023 EV/EBITDA, respectively.

5.4. Conclusion of Tesla Valuation Results

According to the valuation prepared based on DCF approach, the fair value of Tesla share price is $229.95. With respect to relative valuation, the estimated price per share is $147.36 and $223.33, according to 2023 EV/Revenue and 2023 EV/EBITDA methods, respectively. Accordingly, both prices per share with 2023 forward multiples are lower than to the DCF valuation, however, the 2023 EV/EBITDA result is quite similar.

As per Tesla's financial performance, the multiples method may be meaningful as the peer group does not have the same prospects, which may perhaps not be comparable to Tesla. For that reason, the relative valuation results will just be taken into consideration as a check and not as an accurate valuation method, since, perhaps, Tesla's peer group may not be composed by (truly) comparable companies.

Based on above valuation results, Tesla shares are considered to be overvalued, when comparing to the actual market share price $317.69 (on 31 December 2018).

5.5.Sensitivity analysis

Tesla's share price was estimated based on the DCF approach and, to complete the valuation, several assumptions were made. Although the assumptions and forecasts were based on well-known models and estimated in the most accurate way as possible, those variables are uncertain, and it should be beard in mind that are forecasts and not real numbers.

Therefore, a sensitivity analysis is performed to determine the impact of the change of a key value on Tesla's valuation. In this sense, the WAAC will be analysed together with the growth of the terminal value, as this latter has a huge impact on Tesla's enterprise value.

Table 16: Sensitivity analysis to terminal growth rate and WACC (share price in dollars)

		% Change in terminal growth rate						
		2.39%	2.89%	3.39%	**3.89%**	4.39%	4.89%	5.39%
% Change in WACC	6.59%	275.29	326.89	394.60	487.38	622.28	836.44	1228.75
	7.09%	220.49	259.44	308.91	373.83	462.78	592.12	797.45
	7.59%	176.82	206.99	244.34	291.78	354.04	439.33	563.36
	8.09%	141.33	165.19	194.13	**229.95**	275.45	335.16	416.97
	8.59%	112.02	131.22	154.11	181.87	216.24	259.89	317.17
	9.09%	87.49	103.17	121.59	143.55	170.19	203.17	245.05
	9.59%	66.74	79.69	94.74	112.42	133.50	159.06	190.70

A change of 0.5% in WAAC would change the share price on average by $79 and, the terminal growth rate would change on average by $55 (table 16). Although, the terminal value as a huge impact on Tesla valuation, the estimated price is more sensitive to changes in WAAC than in terminal growth rate. Additionally, a sensitivity analysis was also prepared regarding variations on total operating costs, which is represented below:

Table 17: Sensitivity analysis to total operating costs (share price in dollars)

% Δ Operating costs	**+1.5%**	**+1%**	**+0.5%**	**0%**	**-0.5%**	**-1.0%**	**-1.5%**
Tesla's Price per Share	169.35	189.55	209.75	**229.95**	248.91	268.99	289.06

Based on table 17, a 0.5% variation in total operating costs, changes the estimated share price by $20. One may conclude that the share price is less sensitive to operation costs changes.

Overall, a little change in the variables studied above is enough to have a huge effect on Tesla valuation and, consequently on the estimated price per share.

6. Comparison with J.P.Morgan Equity Research

In this chapter, the results from the thesis valuation are compared with J.P.Morgan North America Equity Research report. The valuation of J.P.Morgan on Tesla was released on 28 September 2018 and the price target end date is 31 December 2018.

J.P.Morgam performed a DCF analysis with a time period from 2018 to 2020. In this thesis a DCF approach is also used to value Tesla, however, the chosen forecasting period was 10 years instead of just 3 years. Therefore, the fundamental information comparison between this thesis and the investment bank report will comprise only the years 2018, 2019 and 2020.

Table 18: Comparison with the investment bank valuation

	2018E		2019E		2020E	
	J.P.M	**Thesis**	**J.P.M**	**Thesis**	**J.P.M**	**Thesis**
Automotive	14391	15 866	17 504	19 635	20 438	22 383
Energy generation and storage	1981	1 860	2 938	2 934	3 747	4 118
Services and other	1134	1 381	1 134	1 709	1 134	1 949
Total Revenues	**17 506**	**19 107**	**21 576**	**24 278**	**25 319**	**28 449**
Cost of revenues	14719	15 947	17 551	19 698	20 643	22 944
Gross Profit	**2788**	**3 160**	**4 024**	**4 580**	**4 676**	**5 505**
Gross Margin	***16%***	***17%***	***19%***	***19%***	***18%***	***19%***
R&D	1453	1 624	1 293	1 821	2 202	1 849
SG&A	2763	3 417	2 810	4 099	2 828	4 518
EBIT	**-1533**	**-1 881**	**-79**	**-1 339**	**645**	**-862**

Source: J.P.Morgan Equity Research and own calculations

According to table 18, one shall notice that the estimated revenues on this thesis are more optimist than the ones from J.P.Morgan. However, the estimated services and other revenues remain the same between 2018 and 2020. The thesis assumes a CAGR of 22% for sales, from 2018 to 2020, which corresponds to 2% higher than the 20% of J.P.Morgan. Notwithstanding the above, the gross margin results are almost the same for the period under analysis. Nevertheless, the remaining expenses follow a more conservative approach on the thesis valuation and, as a result, the EBIT calculated is quite lower than the investment bank projections.

The table below demonstrates the main difference in key assumptions used to estimate the equity value of Tesla. Based on the DCF approach, J.P.Morgan presented a price target of $216.00, whereas this thesis estimated a price per share of $229.95. Although the target prices are close, with a difference of about $14, the assumptions behind the valuation are substantially

different (table 19). For instance, the MRP calculated by J.P.Morgan is higher than the one estimated in this thesis, resulting in a higher cost of equity. On the other hand, J.P.Morgan's estimated cost of capital of 3.90% is much lower than the 7.91% of this thesis. Additionally, the tax rate applied is different in 8.38 percentage points.

Table 19: Assumptions and valuation comparison

	J.P.M	Thesis
Rf rate	2.3%	2.4%
Beta	2.00	1.14
MRP	7.1%	5.2%
ke	**16.40%**	**8.36%**
kd	3.90%	7.91%
Tax rate	24.00%	15.62%
After-tax kd	**3.0%**	**6.7%**
Equity	88.5%	84.0%
Debt	11.5%	16.0%
WACC	**14.9%**	**8.09%**

	J.P.M	Thesis
Forecasting period	2018-2020	2018-2027
Enterprise Value	**39 228**	**44 558**
Net Debt	3 726	6 442
Equity Value	**35 502**	**38 116**
Price target (31 Dec. 2018)	**$216.00**	**$229.95**
Price at 31 Dec. 2018	$317.69	

Source: J.P.Morgan Equity Research and own calculations

Overall, despite of the different assumptions followed, the price targets are close and, considering the actual close price on 31 December 2018 ($317.69), the thesis and the investment bank's results imply that Tesla is overvalued by the market and, therefore, both lead to a sell recommendation.

7. Conclusion

The enterprise value obtained from any valuation model depends on numerous factors, some factors are of an objective and quantifiable nature, others are entire of a subjective nature and, are affected by firm-specific and market-wide information. Accordingly, the enterprise value changes as new information is disclosed or known. For that reason, valuation might be perceived as an opinion rather than a scientific fact.

Tesla has characteristics of a young/growth company, with negative net income, high investments and huge revenues growth. A deep analysis of Tesla and of the industry where it operates was done and, the several assumptions and forecasts were determined in the most accurate way as possible and followed well-known methods.

The DCF approach was used to value one share of Tesla, since is perceived to yield the most appropriate results and seen as the most accurate and flexible method by the majority analysts. Additionally, a relative valuation was used based on forward-looking multiples to capture Tesla's potential profit, because of its abnormal revenues' growth and negative earnings. Due to Tesla's financial performance, the relative valuation results were considered simply as a complementary method to DCF.

Based on DCF approach, Tesla's price target obtained is $229.95 from the dissertation and $216 from the equity research done by J.P.Morgan, as of 31 December 2018. Even though the price targets are similar with a difference of less than $15, the assumptions behind each valuation are quite different. Notwithstanding the above, both valuations yield to sell recommendation.

Overall, as per the dissertation valuation, Tesla's share price is $229.95, with a downside of 27.62% and, consequently, is considered to be overvalued, when comparing to the actual market share price $317.69, on 31 December 2018.

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9. Appendix

Appendix 1: Additional Literature Review

Appendix 1.1: Adjusted Present Value

Adjusted present value (APV) is seen as an alternative to WACC as it is more versatile and reliable (Luehrman, 1997). Luehrman (1997) argues that APV should be the chosen approach as it works when WACC does, as well as in some cases when WACC does not. Additionally, most important, APV value any asset that creates future cash and provides information regarding where the value comes from. By contract to WACC approach, that mostly of the time just take into consideration tax effects, APV addresses further financial effects, such as, interest tax shields, costs of financial distress, subsidies, hedges and issue costs (Luehrman, 1997).

If the capital structure is expected to change significantly, the APV is more appropriate to use in these situations rather than WACC approach, even though, the last can still obtain an accurate result (Koller et al., 2010).

In fact, company pay attention to taxes when determining the capital structure as a result of interests being tax deductible. Therefore, by increasing debt, profitable companies can lower their taxes by increasing debt (Koller et al., 2010).

The APV model is given by the sum of both the value of the company under the assumption that the company is all equity financed, in other words, no debt is used, and the net present value of any effect that arise from debt financing by considering the tax benefits and the costs of borrowing, such as financial distress (Pinto et al., 2010). Therefore, the leverage company value is given by:

$$V_L = V_U + \text{PV of expected tax benefits} - \text{PV of expected Bankrupcy costs}$$

Where the value of unlevered firm (V_u) can be computed as follows:

$$V_U = \frac{FCFF * (1 + g)}{R_u - g}$$

The FCFF forecasts are calculated on the same basis as previously explained, however, in APV model, the FCFF is discounted by the unlevered cost of equity (R_u), i.e. the company's cost of equity considering that the company has no debt contracted (Koller et al., 2010).

Furthermore, the unlevered cost of equity is calculated with the current company's equity beta (Damodaran, 2002):

$$\beta_U = \frac{\beta_{current}}{1 + (1 - T)\frac{D}{E}}$$

According to Myers (1974), the value of tax shields is calculated through the equation below:

$$PV(TS) = \sum_{t=1}^{n} \frac{\text{Effective tax rate} * \text{Debt} * R_d}{(1 + R_d)^t}$$

However, Fernández (2004) argues that if it is expected that the capital structure of a company shall change, the PV of tax shield should be computed with the unlevered cost of equity rather than with the cost of debt[7]. The author explains that if it is used the cost of debt instead of the unlevered cost of equity, it is being assumed that the tax savings are similar to the risk of bearing debt.

According to Damodaran (2006), if the value of tax benefits is perceived as constant, the value of tax shields is calculated by multiplying the tax rate, which corresponds to the marginal tax rate, by the total amount of debt[8].

There are three key drivers in particular that affect the present value of financial distress, namely the probability of financial distress, the magnitude of the costs after the company is in distress and the appropriate discount rate for the distress costs. The expected bankruptcy costs arise mostly from the difference between the usual value of an asset and its sale's value when the company is in bankruptcy and sale it. The present value (PV) of expected bankruptcy costs general is:

$$\text{PV of Expected Bankrupcy Costs} = \text{Probability of bankruptcy} * \text{PV of bankruptcy costs} \quad (24)$$

According to Damodaran (2006), the probability of default is based on the bond rating of a company or on the interest coverage amount (appendix 16). Beyond that, there is as well the indirect cost, which Shapiro and Titman (1985) suggest that the indirect costs could range between 25% to 30% of company value. Therefore, the APV approach has some limitations,

[7] $PV(TS) = \sum_{t=1}^{n} \frac{Effective\ tax\ rate * Debt * R_u}{(1+R_u)^t}$

[8] $\frac{T * Debt * R_d}{R_d} = T * D$

since there is a considerable uncertainty regarding the actual probability default and the cost of bankruptcy.

Appendix 1.2: Dividend Discount Model

The Dividend Discount Model (DDM) values the equity of a company, which is the present value of expected future dividends (Damodaran, 2002)

When a shareholder buys and holds a stock, he usually expects to obtain cashflows. These cashflows that are expected to be obtained are dividends, during the holdings period and the market price of the stock at the end of the holding period, i.e. when he sells it (Damodaran, 2006).

Pinto et al. (2010) defines the value of a stock today (V_0) as the present value of the expected dividends to be received during the period of holding (D_t) added to the present value of the expected selling price at the end of the holding period (P_n) discounted at the required rate of return of the stock (R), as follows:

$$V_0 = \sum_{t=1}^{n} \frac{D_t}{(1+R)^t} + \frac{P_n}{(1+R)^n}$$

Damodaran (2006) simplifies the above equation and affirms that as the expected selling price is conditioned by future dividends, the value per share of stock is the present value of expected dividends per share, in perpetuity and, can be written as:

$$\text{Value per share of stock} = \sum_{t=1}^{t=\infty} \frac{E(DPS_t)}{(1+R_e)^t}$$

Therefore, in order to do an equity valuation through the DDM, one must determine the cost of equity, identify the dividends from the most recent period and estimate its future growth. Generally, practitioners estimate the cost of equity through CAPM. Regarding the estimations for forecasting the future dividends, there are two models commonly used (Pinto et al., 2010).

Firstly, the Gordon growth model (also called constant growth model), presented by Gordon (1956), which assumes that expected dividends in the next period (DPS_1) grow indefinitely at a constant rate (g).

$$\text{Value of stock} = \frac{DPS_1}{R_e - g}$$

Pinto et al. (2010) highlight that the required equity return (R_e) must be greater than the expected growth rate.

Nevertheless, authors remark that it is difficult to conclude if a company is in a stable stage and what stable growth rate is appropriate (Damodaran, 2002). Additionally, it is perceived that the presented model is very sensitive to the growth rate chosen, thus, resulting in misleading equity valuations.

Secondly, the Two-stage growth model. Two-stage of growth compose this model, first an initial phase where the growth rate is not constant (extraordinary phase) and second a phase where the growth rate remains stable over the next years (terminal price) (Damodaran, 2002). Therefore, the value of stock based on the Two-stage growth model can be written as:

$$\text{Value of stock} = \sum_{t=1}^{t=n} \frac{DPS_t}{(1+R_{e,hg})^t} + \frac{P_n}{(1+R_{e,hg})^n} \quad \text{and} \quad P_n = \frac{DPS_{n+1}}{(R_{e,st} - g_n)}$$

Where:

DPS_t = Expected dividends per share in year t

R_e = Cost of equity (hg: high growth period; st: stable growth period)

P_n = Price (terminal price) at the end of year n

g_n = Steady state growth rate forever after year n

Pinto et al., (2010) explains that even though a company has non-dividend paying shares, in theory, DDM can be applied on that company, but generally in practice it cannot. This happen because it is difficult to predict when the company will start to distribute dividends and the amount of future dividends without any historical data and knowledge about the future implemented dividend policy (Pinto et al., 2010).

The Dividend Discounted Model is best suited for companies paying dividends, with a well-defined dividend policy, which have an understandable and a consistent relationship of dividends to earnings and, whose investors takes a no control perspective (Pinto et al., 2010).

Additionally, is important to note that a company may decide to not distribute dividends even if it is profitable, in order to reinvest earnings and gain market share. Further, in some cases, the company may opt to use debt to maintain the same amount of dividend distributed with the aim of not reducing them. Therefore, the company's decision regarding dividend distributions may bias the equity valuation done through the DDM and mislead the results.

Appendix 1.3: Economic Value Added

The Economic Value Added (EVA) is an excess return model. Excess return models value a company as the sum of both Capital Invested in the company today and the present value of excess return cash flows from existing and future projects (Damodaran, 2006)

Economic Value Added is a "measure of the dollar surplus value created by an investment or a portfolio of investments" (Damodaran, 2006, p.37). In order to estimate the EVA it is needed three components: the return on capital earned on an investment, the cost of capital used for that investment and, the capital invested in it:

$$\text{EVA} = (\text{ROIC}) * \text{Capital Invested} =$$

$$= \text{After tax operating income} - (\text{Cost of Capital}) * \text{Capital Invested}$$

According to Damodaran (2006), the enterprise value is the sum of both value of an asset in place and the value of expected future growth. EVA is an extension of the net present value and also based on the principle of DCF approach. Additionally, the enterprise value based on EVA approach, which should be estimated with market values rather than book values, corresponds to the invested capital and, to both PV of the EVA of the project in place and the PV of EVA by future projects discounted at cost of capital, as the following equation:

$$\text{Enterprise Value}$$

$$= \text{Capital Invested}_{\text{Assets in Place}} + \sum_{t=1}^{t=\infty} \frac{\text{EVA}_{t,\text{Assets in Place}}}{(1+\text{R}_c)^t}$$

$$+ \sum_{t=1}^{t=\infty} \frac{\text{EVA}_{t,\text{Future Projrect}}}{(1+\text{R}_c)^t}$$

The presented model has some limitations, such as the difficulty of estimating the value existing assets. In addition, due to this referred difficulty, it is usually used book values. However, for example, using book values for calculating cost of capital "tend to understate cost of capital for most firms and will understate it more for more highly levered firms than for lightly levered firms" (Damodaran. 2002, p.1224). Consequently, the understating cost of capital will lead to overstating the EVA.

Appendix 2: Historical Balance Sheet

(Expressed in thousands of dollars, except per share data)

	2010	2011	2012	2013	2014	2015	2016	2017
Assets								
Cash and cash equivalents	99 558	255 266	201 890	845 889	1 905 713	1 196 908	3 393 216	3 367 914
Short-term marketable securities	-	25 061	-	-	-	-	-	
Restricted cash	73 597	23 476	19 094	3 012	17 947	22 628	105 519	155 323
Accounts receivable, net	6 710	9 539	26 842	49 109	226 604	168 965	499 142	515 381
Inventory	45 182	50 082	268 504	340 355	953 675	1 277 838	2 067 454	2 263 537
Prepaid expenses and other current assets	10 839	9 414	8 438	27 574	76 134	115 667	194 465	268 365
Total current assets	235 886	372 838	524 768	1 265 939	3 180 073	2 782 006	6 259 796	6 570 520
Operating lease vehicles, net	7 963	11 757	10 071	382 425	766 744	1 791 403	3 134 080	4 116 604
Solar energy systems, leased and to be leased, net	-	-	-	-	-	-	5 919 880	6 347 490
Property, plant and equipment, net	114 636	298 414	552 229	738 494	1 829 267	3 403 334	5 982 957	10 027 522
Intangible assets, net	-	-	-	-	-	12 816	376 145	361 502
Goodwill	-	-	-	-	-	-	-	60 237
MyPower customer notes receivable, net of current portion	-	-	-	-	-	-	506 302	456 652
Restricted cash, net of current portion	4 867	8 068	5 159	6 435	11 374	31 522	268 165	441 722
Other assets	22 730	22 371	21 963	23 637	43 209	46 858	216 751	273 123
Total non-current assets	150 196	340 610	589 422	1 150 991	2 650 594	5 285 933	16 404 280	22 084 852
Total Assets	**386 082**	**713 448**	**1 114 190**	**2 416 930**	**5 830 667**	**8 067 939**	**22 664 076**	**28 655 372**
Liability and Equity								
Accounts payable	28 951	56 141	303 382	303 969	777 946	916 148	1 860 341	2 390 250
Accrued liabilities and other	20 945	32 109	39 798	108 252	268 883	422 798	1 210 028	1 731 366
Deferred revenue	4 635	2 345	1 905	91 882	191 651	423 961	763 126	1 015 253
Resale value guarantees	-	-	-	-	-	136 831	179 504	787 333
Customer deposits =reservation payments	30 755	91 761	138 817	163 153	257 587	283 370	663 859	853 919
Convertible Senior Notes(debt), less current portion	-	-	-	182	-	-	-	-
Current portion of long-term debt and capital leases	279	8 983	50 841	7 722	611 099	627 927	984 211	796 549

Current portion of solar bonds issued to related parties	-	-	4 365	-	-	-	165 936	100 000
Current portion of current Debt	279	8 983	55 206	7 904	611 099	627 927	1 150 147	896 549
Total current liabilities	85 565	191 339	539 108	675 160	2 107 166	2 811 035	5 827 005	7 674 670
Common Stock warrant liability	6 088	8 838	10 692	-	-	-	-	-
Long-term debt, net of current portion	71 828	268 335	401 495	586 119	-	-	-	-
Capital leasess, net of current portion	496	2 830	9 965	12 855	-	-	-	-
Long-term debt and capital leases, net of current portion	-	-	-	-	1 818 785	2 021 093	5 860 049	9 415 700
Solar bonds issued to related parties, net of current portion	-	-	-	-	-	-	99 164	100
Convertible senior notes issued to related parties	-	2 430	-	-	-	-	10 287	2 519
Long term Debt	72 324	271 165	411 460	598 974	1 818 785	2 021 093	5 969 500	9 418 319
Deferred revenue, net of current portion	2 783	3 146	3 060	181 180	292 271	446 105	851 790	1 177 799
Resale value guarantees, net of current portion	-	-	-	236 299	487 879	1 293 741	2 210 423	2 309 222
Other long-term liabilities	12 274	14 915	25 170	58 197	154 660	364 976	1 891 449	2 442 970
Total non-current liabilities	165 793	571 659	861 842	1 673 624	4 572 380	6 147 008	16 892 662	24 766 629
Total liabilities	**179 034**	**489 403**	**989 490**	**1 749 810**	**4 860 761**	**6 936 950**	**16 750 167**	**23 022 980**
Commitments and contingencies	-	-	-	-	-	-	-	-
Redeemable noncontrolling interests in subsidiaries	-	-	-	-	-	-	367 039	397 734
Convertible senior notes	-	-	-	-	58 196	47 285	8 784	70
Stockholders' equity:								
Preferred stock; $0.001 par value; 100,000 shares authorized; no shares issued and outstanding	-	-	-	-	-	-	-	-
Common stock; $0.001 par value; 2,000,000 shares authorized, 168,797 and 161,561 shares and outstanding as of December 31, 2017 and December 31, 2016, respectively	95	104	115	123	126	131	161	169
Additional paid-in capital	621 935	893 336	1 190 191	1 806 617	2 345 266	3 409 452	7 773 727	9 178 024
Accumulated other comprehensive gain (loss)	-	(3)			(22)	(3 556)	(23 740)	33 348
Accumulated deficit	(414 982)	(669 392)	(1 065 606)	(1 139 620)	(1 433 660)	(2 322 323)	(2 997 237)	(4 974 299)
Total stockholders' equity	**207 048**	**224 045**	**124 700**	**667 120**	**911 710**	**1 083 704**	**4 752 911**	**4 237 242**
Noncontrolling interests in subsidiaries	-	-	-	-	-	-	785 175	997 346
Total Liability and Equity	**386 082**	**713 448**	**1 114 190**	**2 416 930**	**5 830 667**	**8 067 939**	**22 664 076**	**28 655 372**

Appendix 3: Historical Income Statement

(Expressed in thousands of dollars, except per share data)

	2010	2011	2012	2013	2014	2015	2016	2017
Revenues								
Automotive	97 078	148 568	385 699	1 921 877	2 874 448	3 431 587	5 589 007	8 534 752
Automotive leasing					132 564	309 386	761 759	1 106 548
Total automotive revenue	97 078	148 568	385 699	1 921 877	3 007 012	3 740 973	6 350 766	9 641 300
Energy generation and storage					4 208	14 477	181 394	1 116 266
Services and other	19 666	55 674	27 557	91 619	187 136	290 575	467 972	1 001 185
Total Revenues	**116 744**	**204 242**	**413 256**	**2 013 496**	**3 198 356**	**4 046 025**	**7 000 132**	**11 758 751**
Cost of revenues								
Automotive	79 982	115 482	371 658	1 483 321	2 058 344	2 639 926	4 268 087	6 724 480
Automotive leasing					87 405	183 376	481 994	708 224
Total automotive cost of revenues	79 982	115 482	371 658	1 483 321	2 145 749	2 823 302	4 750 081	7 432 704
Energy generation and storage					4 005	12 287	178 332	874 538
Services and other	6 031	27 165	11 531	73 913	166 931	286 933	472 462	1 229 022
Total cost of revenues	**86 013**	**142 647**	**383 189**	**1 557 234**	**2 316 685**	**3 122 522**	**5 400 875**	**9 536 264**
Gross Profit	**30 731**	**61 595**	**30 067**	**456 262**	**881 671**	**923 503**	**1 599 257**	**2 222 487**
Operating expenses								
Research and development	92 996	208 981	273 978	231 976	464 700	717 900	834 408	1 378 073
Selling, general and administrative	84 573	104 102	150 372	285 569	603 660	922 232	1 432 189	2 476 500
Total operating expenses	**177 569**	**313 083**	**424 350**	**517 545**	**1 068 360**	**1 640 132**	**2 266 597**	**3 854 573**
Loss from operations - EBIT	**(146 838)**	**(251 488)**	**(394 283)**	**(61 283)**	**(186 689)**	**(716 629)**	**(667 340)**	**(1 632 086)**
Interest income	258	255	288	189	1 126	1 508	8 530	19 686
Interest expense	(992)	(43)	(254)	(32 934)	(100 886)	(118 851)	(198 810)	(471 259)
Other (expense) income, net	(6 583)	(2 646)	(1 828)	22 602	1 813	(41 652)	111 272	(125 373)
Loss before income taxes - EBT	**(154 155)**	**(253 922)**	**(396 077)**	**(71 426)**	**(284 636)**	**(875 624)**	**(746 348)**	**(2 209 032)**
Provision for income taxes	173	489	136	2 588	9 404	13 039	26 698	31 546
Net loss	**(154 328)**	**(254 411)**	**(396 213)**	**(74 014)**	**(294 040)**	**(888 663)**	**(773 046)**	**(2 240 578)**

Net loss attributable to noncontrolling interests and redeemable noncontrolling interests							(98 132)	(279 178)
Net loss attributable to common stockholders	**(154 328)**	**(254 411)**	**(396 213)**	**(74 014)**	**(294 040)**	**(888 663)**	**(674 914)**	**(1 961 400)**
Net loss per share of common stock attributable to common stockholders								
Basic	(3)	(3)	(3.69)	(0.62)	(2.36)	(6.93)	(4.68)	(11.83)
Diluted	(3)	(3)	(3.69)	(0.62)	(2.36)	(6.93)	(4.68)	(11.83)
Weighted average shares used in computing net loss per share of common stock								
Basic	50 718	100 389	107 349	119 421	124 539	128 202	144 212	165 758
Diluted	50 718	100 389	107 349	119 421	124 539	128 202	144 212	165 758

Appendix 4: Forecasted Income Statement

(Expressed in thousands of dollars, except per share data)

	2018E	2019E	2020E	2021E	2022E	2023E	2024E	2025E	2026E	2027E
Revenues										
Automotive	14 894 628	18 433 168	21 012 783	24 078 041	27 732 651	30 967 167	33 864 190	35 967 230	37 123 994	38 146 574
Automotive leasing	971 005	1 201 688	1 369 857	1 569 686	1 807 936	2 018 799	2 207 661	2 344 761	2 420 172	2 486 836
Total automotive revenue	15 865 633	19 634 856	22 382 640	25 647 727	29 540 587	32 985 966	36 071 851	38 311 991	39 544 167	40 633 410
Energy generation and storage	1 859 822	2 933 852	4 117 829	4 934 101	5 352 572	6 068 686	6 573 666	7 334 234	8 162 451	8 967 384
Energy generation	1 670 472	2 555 152	3 360 429	3 849 101	4 040 072	4 153 066	4 266 386	4 611 929	5 000 657	5 340 487
Energy storage	189 350	378 700	757 400	1 085 000	1 312 500	1 915 620	2 307 281	2 722 304	3 161 793	3 626 897
Services and other	1 381 203	1 709 337	1 948 549	2 232 795	2 571 693	2 871 635	3 140 280	3 335 299	3 442 567	3 537 393
Total Revenues	**19 106 657**	**24 278 044**	**28 449 018**	**32 814 624**	**37 464 852**	**41 926 287**	**45 785 798**	**48 981 523**	**51 149 185**	**53 138 187**
Cost of revenues										
Automotive	11 796 512	14 460 158	16 276 078	17 954 359	19 875 838	21 464 555	22 757 828	23 230 922	23 805 424	24 290 925
Automotive leasing	581 125	719 183	819 829	939 422	1 082 010	1 208 207	1 321 236	1 403 288	1 448 420	1 488 316
Total automotive cost of revenues	**12 377 637**	**15 179 342**	**17 095 907**	**18 893 781**	**20 957 848**	**22 672 762**	**24 079 064**	**24 634 210**	**25 253 844**	**25 779 241**
Energy generation and storage	1 675 239	2 642 675	3 709 146	4 444 405	4 821 344	5 466 385	5 921 248	6 606 331	7 352 350	8 077 396
Services and other	1 893 948	1 876 131	2 138 684	2 450 667	2 822 633	3 151 843	3 446 702	3 660 750	3 778 486	3 882 564
Total cost of revenues	**15 946 824**	**19 698 147**	**22 943 737**	**25 788 853**	**28 601 825**	**31 290 990**	**33 447 014**	**34 901 291**	**36 384 680**	**37 739 201**
Gross Profit	**3 159 833**	**4 579 897**	**5 505 281**	**7 025 771**	**8 863 027**	**10 635 297**	**12 338 783**	**14 080 232**	**14 764 505**	**15 398 986**
Operating expenses										
Research and development	1 623 825	1 820 547	1 848 827	1 804 390	2 060 094	2 305 416	2 517 641	2 693 365	2 812 559	2 921 929
Selling, general and administrative	3 416 696	4 098 675	4 518 338	4 883 547	5 200 956	5 401 039	5 440 372	5 330 281	5 054 679	5 251 236
Total operating expenses	**5 040 520**	**5 919 221**	**6 367 164**	**6 687 937**	**7 261 050**	**7 706 456**	**7 958 013**	**8 023 646**	**7 867 238**	**8 173 166**
Income (loss) from operations - EBIT	**(1 880 687)**	**(1 339 324)**	**(861 884)**	**337 834**	**1 601 978**	**2 928 841**	**4 380 770**	**6 056 587**	**6 897 268**	**7 225 821**
Interest income	19 308	31 373	39 864	46 713	53 881	61 516	68 842	75 179	80 427	83 986
Interest expense	(682 755)	(1 070 076)	(1 306 146)	(1 494 467)	(1 655 885)	(1 828 531)	(1 988 352)	(2 111 107)	(2 188 602)	(2 256 260)
Other (expense) income, net										
Income (Loss) before income taxes - EBT	**(2 544 134)**	**(2 378 028)**	**(2 128 166)**	**(1 109 920)**	**(27)**	**1 161 827**	**2 461 260**	**4 020 659**	**4 789 092**	**5 053 546**

Provision for income taxes	22 283	33 959	30 391	15 850	0	181 477	384 449	628 027	748 056	789 364
Net income (loss)	**(2 566 418)**	**(2 411 987)**	**(2 158 557)**	**(1 125 771)**	**(27)**	**980 350**	**2 076 811**	**3 392 632**	**4 041 036**	**4 264 182**
Net loss attributable to noncontrolling interests and redeemable noncontrolling interests	(322 782)	(303 359)	(271 485)	(141 590)	(3)	123 300	261 204	426 696	508 247	536 312
Net loss attributable to common stockholders	**(2 243 636)**	**(2 108 628)**	**(1 887 072)**	**(984 181)**	**(24)**	**857 050**	**1 815 608**	**2 965 936**	**3 532 789**	**3 727 870**
Net loss per share of common stock attributable to common stockholders										
Basic	(13.13)	(11.30)	(9.26)	(4.43)	(0.00)	3.23	6.27	9.38	10.24	9.90
Diluted	(13.13)	(11.47)	(9.49)	(4.53)	(0.00)	3.38	6.62	9.99	10.98	10.72
Weighted average shares used in computing net loss per share of common stock										
Basic	170 893	186 581	203 710	222 411	242 829	265 121	289 460	316 033	345 045	376 721
Diluted	170 893	183 797	198 875	217 283	235 990	253 321	274 075	296 881	321 655	347 910

Appendix 5: Historical and Forecasted Production and Deliveries by Model

	2013	2014	2015	2016	2017	2018E	2019E	2020E	2021E	2022E	2023E	2024E	2025E	2026E	2027E
Production (in units)															
Model S	23 187	35 125	50 835	56 022	53 092	54 003	56 262	58 615	61 066	63 620	64 893	66 190	67 514	68 865	70 242
Model X			260	27 900	45 250	50 047	55 052	60 557	66 612	73 274	79 136	85 466	90 594	94 218	96 102
Model 3					2 685	148 147	184 318	229 320	285 309	354 968	423 887	484 992	530 655	557 188	585 048
Total production	**23 187**	**35 125**	**51 095**	**83 922**	**101 027**	**252 197**	**295 631**	**348 491**	**412 988**	**491 862**	**567 915**	**636 649**	**688 764**	**720 271**	**751 392**
Deliveries (in units)															
Model S	22 477	31 655	50 446	50 950	54 754	51 600	53 758	56 007	58 349	60 789	62 005	63 245	64 510	65 800	67 116
Model X			212	25 335	46 558	47 820	52 602	57 862	63 648	70 013	75 614	81 663	86 563	90 026	91 826
Model 3					1 772	141 555	176 117	219 116	272 614	339 174	405 026	463 412	507 044	532 396	559 016
Total deliveries	**22 477**	**31 655**	**50 658**	**76 285**	**103 084**	**240 975**	**282 477**	**332 985**	**394 611**	**469 976**	**542 645**	**608 320**	**658 117**	**688 222**	**717 958**

Appendix 6: Forecasted Average Sale Price by Model

	2019E	2020E	2021E	2022E	2023E	2024E	2025E	2026E	2027E
Model S	$96 105	$96 105	$96 105	$96 105	$95 144	$94 193	$93 251	$92 318	$91 395
Model X	$102 555	$102 555	$102 555	$102 555	$101 529	$100 514	$99 509	$98 514	$97 529
Model 3	$44 699	$44 252	$43 809	$43 371	$42 937	$42 508	$42 083	$41 662	$41 245

Appendix 7: Forecasted Automotive Revenue by Model

(in thousands of dollars)

	2019E	2020E	2021E	2022E	2023E	2024E	2025E	2026E	2027E
Model S	5 166 426	5 382 509	5 607 630	5 842 166	5 899 420	5 957 234	6 015 615	6 074 568	6 134 099
Model X	5 394 598	5 934 058	6 527 464	7 180 210	7 677 081	8 208 335	8 613 826	8 868 796	8 955 710
Model 3	7 872 143	9 696 216	11 942 947	14 710 275	17 390 667	19 698 622	21 337 788	22 180 631	23 056 766
Automotive revenues	**18 433 168**	**21 012 783**	**24 078 041**	**27 732 651**	**30 967 167**	**33 864 190**	**35 967 230**	**37 123 994**	**38 146 574**

Appendix 8: Forecasted Energy Generation Revenues

(Energy generation revenues in thousands of dollars)

	2018E	2019E	2020E	2021E	2022E	2023E	2024E	2025E	2026E	2027E
Solar Photovoltaic - Generation										
Energy Consumption (quadrillion Btu)		0.68	0.85	0.94	0.96	0.96	0.96	1.01	1.06	1.10
% Growth		*46.33%*	*23.77%*	*11.55%*	*1.52%*	*0.09%*	*0.49%*	*5.13%*	*4.77%*	*3.31%*
Electricity Price (cents per kilowatt-h)		10.69	10.92	10.91	10.95	10.97	11.00	11.12	11.15	11.18
% Growth		*0.94%*	*2.20%*	*-0.07%*	*0.31%*	*0.22%*	*0.27%*	*1.08%*	*0.32%*	*0.19%*
World Energy Consumption										
Renewable Energy Consumption		81.46	84.70	87.04	89.70	91.93	93.72	95.34	98.35	101.47
% Growth		*3.56%*	*3.98%*	*2.76%*	*3.07%*	*2.48%*	*1.95%*	*1.73%*	*3.16%*	*3.17%*
Energy generation revenues	**1 670 472**	**2 555 152**	**3 360 429**	**3 849 101**	**4 040 072**	**4 153 066**	**4 266 386**	**4 611 929**	**5 000 657**	**5 340 487**

Appendix 9: Forecasted World and US Energy Storage Market Size

(in thousands of dollars)

	2019E	2020E	2021E	2022E	2023E	2024E	2025E	2026E	2027E
Tesla US Market share (in 2016)	**32.33%**								
U.S. Annual Energy Storage Market Size	1 082 000	2 164 000	3 100 000	3 750 000	4 561 000	4 708 736	4 861 258	5 018 720	5 181 282
% Growth	*100%*	*100%*	*43%*	*21%*	*22%*	*3%*	*3%*	*3%*	*3%*
% of Global	*14%*	*14%*	*14%*	*14%*	*14%*	*14%*	*14%*	*14%*	*14%*
RoW Energy Storage Market Size	6 492 000	12 984 000	18 600 000	22 500 000	27 366 000	28 252 417	29 167 546	30 112 318	31 087 691
% Growth	*100%*	*100%*	*43%*	*21%*	*22%*	*3%*	*3%*	*3%*	*3%*
% of Global	*86%*	*86%*	*86%*	*86%*	*86%*	*86%*	*86%*	*86%*	*86%*
Global Annual Energy Storage Market Size	7 574 000	15 148 000	21 700 000	26 250 000	31 927 000	32 961 153	34 028 804	35 131 037	36 268 973
Global /US market	*7x*	*7x*	*7x*	*7x*	*7x*	*7x*	*7x*	*7x*	*7x*

Source: GTM Research, Morgan Stanley Report and own calculations

Appendix 10: Forecasted Energy Storage Revenues

(in thousands of Dollars)

	2019E	2020E	2021E	2022E	2023E	2024E	2025E	2026E	2027E
Tesla US energy storage	349 847	699 693	1 002 333	1 212 500	1 474 723	1 522 491	1 571 807	1 622 719	1 675 281
Tesla Rest of the World energy storage	28 853	57 707	82 667	100 000	440 897	784 789	1 150 498	1 539 074	1 951 616
Energy Storage	**378 700**	**757 400**	**1 085 000**	**1 312 500**	**1 915 620**	**2 307 281**	**2 722 304**	**3 161 793**	**3 626 897**
% Global annual energy storage market share	*5%*	*5%*	*5%*	*5%*	*6%*	*7%*	*8%*	*9%*	*10%*

Appendix 11: Reduction on Automotive Cost of Revenues

(in $/kWH)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
BNEF Lithium-ion batterry price survey	1000	800	642	599	540	350	273	238	205	200	193	171.5	150	133	118	100	97	94
% Decrease		*-20%*	*-20%*	*-7%*	*-10%*	*-35%*	*-22%*	*-13%*	*-14%*	*-2%*	*-4%*	*-11%*	*-13%*	*-11%*	*-11%*	*-15%*	*-3%*	*-3%*
% Bettery cost of total vehicle cost							48%	45%	42%	39%	36%	34%	31%	29%	27%	26%	24%	23%
Reduction on automotive cost of revenues										**-1%**	**-1%**	**-4%**	**-4%**	**-3%**	**-3%**	**-4%**	**-1%**	**-1%**

Source: BlombergNEF (BNEF) and own calculations

Appendix 12: DP&A and PP&E

(in thousands of dollars)

	2010	2011	2012	2013	2014	2015	2016	2017
Depreciation and Amortization	10 623	16 919	28 825	106 083	231 931	422 590	947 099	1 636 003
Property, plant and equipment, net	114 636	298 414	552 229	738 494	1 829 267	3 403 334	5 982 957	0 027 522
Capex		200 697	282 640	292 348	1 322 704	1 996 657	3 526 722	5 680 568

(in thousands of dollars)

	2018E	2019E	2020E	2021E	2022E	2023E	2024E	2025E	2026E	2027E
Depreciation and Amortization	1 908 470	2 425 014	2 841 632	3 277 691	3 742 179	4 187 810	4 573 318	4 892 523	5 109 040	5 307 712
Property, plant and equipment, net	13 326 243	16 933 109	19 842 221	22 887 083	26 130 459	29 242 158	31 934 035	34 162 945	35 674 815	37 062 077
Capex	5 207 191	6 031 881	5 750 744	6 322 553	6 985 555	7 299 509	7 265 195	7 121 433	6 620 910	6 694 973

Appendix 13: Changes in Working Capital

(in thousands of dollars)

	2018E	2019E	2020E	2021E	2022E	2023E	2024E	2025E	2026E	2027E
Current Asset										
Restricted cash	252 383	320 692	375 787	433 453	494 879	553 810	604 791	647 004	675 637	701 910
Accounts receivable, net	837 437	1 064 096	1 246 908	1 438 251	1 642 068	1 837 611	2 006 772	2 146 839	2 241 847	2 329 024
Inventory	3 785 154	4 675 572	5 445 948	6 121 268	6 788 957	7 427 260	7 939 016	8 284 205	8 636 303	8 957 814
Prepaid expenses and other CA	436 063	554 088	649 280	748 914	855 044	956 866	1 044 950	1 117 885	1 167 356	1 212 750
Operating lease vehicles, net	6 883 907	8 503 275	9 904 327	11 132 504	12 346 804	13 507 660	14 438 370	15 066 151	15 706 499	16 291 217
Total current assets	**12 194 944**	**15 117 722**	**17 622 251**	**19 874 390**	**22 127 753**	**24 283 208**	**26 033 899**	**27 262 083**	**28 427 642**	**29 492 715**
Current Liabilities										
Accounts payable	3 997 047	4 937 311	5 750 813	6 463 937	7 169 004	7 843 039	8 383 443	8 747 955	9 119 764	9 459 273
Accrued liabilities and other	2 813 276	3 574 715	4 188 852	4 831 646	5 516 349	6 173 253	6 741 530	7 212 071	7 531 239	7 824 101
Deferred revenue	1 649 673	2 096 171	2 456 294	2 833 221	3 234 723	3 619 924	3 953 155	4 229 075	4 416 231	4 587 962
Resale value guarantees	1 279 328	1 625 590	1 904 866	2 197 175	2 508 541	2 807 267	3 065 689	3 279 665	3 424 806	3 557 984
Customer deposits	1 387 523	1 763 068	2 065 964	2 382 994	2 720 693	3 044 682	3 324 959	3 557 032	3 714 447	3 858 888
Total current liabilities	**11 126 847**	**13 996 855**	**16 366 789**	**18 708 973**	**21 149 310**	**23 488 165**	**25 468 776**	**27 025 798**	**28 206 488**	**29 288 208**
Net (non-cash) working (deficit) capital	**1 068 096**	**1 120 867**	**1 255 462**	**1 165 416**	**978 443**	**795 043**	**565 124**	**236 285**	**221 154**	**204 507**
Changes in working capital	**527 007**	**52 771**	**134 594**	**(90 045)**	**(186 973)**	**(183 400)**	**(229 919)**	**(328 839)**	**(15 131)**	**(16 647)**

Appendix 14: Assumptions for DCF Valuation

	2018	Notes
U.S. Treasuries 10Y (Rf)	2.41%	U.S. 10Y Government bond on 31 December 2017
Market Risk Premium (Rm-Rf)	5.22%	Own calculations
Levered Beta	1.14	Own calculations
Unlevered Beta	0.98	$B_U = B_{current}/(1+(1-T)*(D/E))$
Spread Rating (Kd)	5.5%	Moody's credit rating and Damodaran
Terminal Growth Rate (g)	3.89%	Growth rate of the last year
Income Tax Rate (Tc)	15.62%	Industry effective tax rate
Number of outstanding shares	165 758	Number of outstanding shares on 31 December 2017 | Expressed in thousands
Share Price	311.64	Share price on 31 December 2017
Equity @MV	51 656 823	Expressed in thousands of dollars
Debt @MV	9 835 004	Interest Expense*((1-(1/(1+kd)^y))/kd) + debt/(1+kd)^y (Damodaran) | Expressed in thousands of dollars
D/E Ratio @MV	0.19	Own calculations
D/V Ratio @MV	16%	Own calculations
E/V Ratio @MV	84%	Own calculations
Equity @BV	4 237 242	Expressed in thousands of dollars
Debt @BV	10 314 868	Expressed in thousands of sollars
D/E Ratio @BV	2.43	Own calculations
D/V Ratio @BV	71%	Own calculations
E/V Ratio @BV	29%	Own calculations

Appendix 15: DCF Calculations

		2018E	2019E	2020E	2021E	2022E	2023E	2024E	2025E	2026E	2027E
	Revenues	19 106 657	24 278 044	28 449 018	32 814 624	37 464 852	41 926 287	45 785 798	48 981 523	51 149 185	53 138 187
	Operations Expenses	20 987 344	25 617 369	29 310 902	32 476 790	35 862 874	38 997 446	41 405 027	42 924 936	44 251 917	45 912 367
	EBIT	**(1 880 687)**	**(1 339 324)**	**(861 884)**	**337 834**	**1 601 978**	**2 928 841**	**4 380 770**	**6 056 587**	**6 897 268**	**7 225 821**
	Tc	-1.43%	-1.43%	-1.43%	-1.43%	-1.43%	15.62%	15.62%	15.62%	15.62%	15.62%
+	**EBIT*(1-tax rate)**	**(1 907 544)**	**(1 358 450)**	**(874 192)**	**342 658**	**1 624 855**	**2 471 356**	**3 696 494**	**5 110 548**	**5 819 914**	**6 097 147**
+	Depreciation	1 908 470	2 425 014	2 841 632	3 277 691	3 742 179	4 187 810	4 573 318	4 892 523	5 109 040	5 307 712
	CF from Operations	**926**	**1 066 564**	**1 967 440**	**3 620 349**	**5 367 034**	**6 659 166**	**8 269 812**	**10 003 071**	**10 928 954**	**11 404 859**
-	Capex	5 207 191	6 031 881	5 750 744	6 322 553	6 985 555	7 299 509	7 265 195	7 121 433	6 620 910	6 694 973
-	Change in WC	527 007	52 771	134 594	(90 045)	(186 973)	(183 400)	(229 919)	(328 839)	(15 131)	(16 647)
=	**FCFF**	**(5 733 272)**	**(5 018 088)**	**(3 917 899)**	**(2 612 158)**	**(1 431 548)**	**(456 943)**	**1 234 536**	**3 210 477**	**4 323 175**	**4 726 533**
	PV of FCFF	(5 304 129)	(4 294 982)	(3 102 328)	(1 913 575)	(970 205)	(286 504)	716 118	1 722 907	2 146 380	55 844 374
	Enterprise Value	**$44 558 054**									
	Debt MV	$9 835 004									
	Cash and cash equivalent	$3 393 216									
	Net Debt	**$6 441 788**									
	Equity Value	**$38 116 267**									
	# Shares	165 758									
	Price per Share	**$229.95**									

Appendix 16: Implied Default Spread

Rating	Default Spread
Aaa/AAA	0.60%
Aa2/AA	0.80%
A1/A+	1.00%
A2/A	1.10%
A3/A-	1.25%
Baa2/BBB	1.60%
Ba1/BB+	2.50%
Ba2/BB	3.00%
B1/B+	3.75%
B2/B	4.50%
B3/B-	5.50%
Caa/CCC	6.50%
Ca2/CC	8.00%
C2/C	10.50%
D2/D	14.00%

Source: Damodaran (1998)