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Unraveling the Tesla Phenomenon: A Comprehensive Analysis of Stock Valuation and Discrepancy between Price and Value Factors

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Abstract

Tesla has emerged as one of the most globally recognized companies, particularly in the automotive and renewable energy sectors. The company's recent influence, both within and outside the stock market, has sparked considerable debate. Under the leadership of Elon Musk and a highly skilled team of engineers, Tesla has rapidly ascended to the pinnacle of the business and technological world, becoming one of the most valuable and pioneering companies globally. This transformation from a niche player to a mainstream corporation across diverse industries, as well as a heavily disputed valuation, warrants a closer examination to provide insight into why this meteoric rise occurred and what to anticipate in the future to provide crucial information for current and prospective investors. This work encompasses the company's retrospective, current status, and future outlook. Moreover, we determine the value of Tesla shares, utilizing various valuation models such as the discounted cash flow (DCF) model, economic value added (EVA) model, and multiples model. Recognizing that assessing the value of an innovative and ambitious company like Tesla extends beyond financial statements alone, the study also delves into the impact of behavioral finance and investor sentiment on Tesla's valuation. As of December 29, 2023, Tesla's stock price was $248.48 and with the number of outstanding shares at 3.18 billion, making its market cap sit at a whopping $790 billion.

Keywords: Investment Decisions, Pricing Models, Price, Value, Stocks, Tesla, Behavioral Finance.

Resumo

Tesla apareceu, nos últimos anos, como umas das empresas mais populares e conceituadas do Mundo, em particular nos setores automóvel e de energias renováveis. A evolução recente da empresa, seja na sua atividade ou no mercado de ações, tem gerado um intenso debate entre especialistas e entusiastas. Sob a liderança de Elon Musk e dotada de uma equipa de engenheiros de topo, a Tesla rapidamente ascendeu ao topo do mundo empresarial e tecnológico, tornando-se numa das empresas mais valiosas e inovadoras a nível global. Esta transformação de uma empresa que trabalhava essencialmente num nicho, para uma empresa internacional e com presença habitual na sociedade e cultura, tal como um valor de mercado que é alvo de forte debate, são razões que dão azo a uma necessidade de fazer uma análise profunda de modo a compreender o que justifica esta ascensão vertiginosa de valor e o que investidores podem esperar da empresa no futuro. Assim sendo, este trabalho englobará uma análise passada, presente e futura da Tesla. Adicionalmente, iremos calcular o valor de uma ação da Tesla usando diversos modelos financeiros, tais como: Fluxos de Caixa Descontados, Valor Económico Adicionado e o Modelo de Múltiplos. Reconhecendo que a avaliação das ações de uma empresas com as caraterísticas da Tesla, que é altamente ambiciosa e inovadora, tem que ir além dos modelos financeiros tradicionais e das demonstrações financeiras, e como tal pretendemos dar uso de finança comportamental e sentimento de investidores para justificar parte da diferença observada entre o valor e o preço das ações. Aquando de 29 de dezembro de 2023, o preço das ações da Tesla era de $248.48 e com o número de ações fixado a 3.18 mil milhões, fazendo com que a empresa tenha um valor de mercado de $790 mil milhões.

Palavras-Chave: Decisões de Investimento, Preço, Valor, Modelos Financeiros de *Pricing*, Ações, Tesla, Finança Comportamental.

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Introduction

Investors worldwide need help deciding whether to invest, when is the right time to do so, or even in what industry. However, to properly dissipate these doubts, research is needed to estimate what a certain company is worth at a certain point and why that is.

The main goal of this master thesis is to study, analyze, and dissect Tesla, Inc., one of the world's most interesting stock market phenomena, using an array of different valuation models and comparing the results with each other and ultimately with the observed reality. Additionally, we intend to understand what underlies the discrepancy observed between the value and price of Tesla stock, ranging from behavioral finance, noise traders, areas of business and company culture and mission.

Tesla was the chosen enterprise due to its business model, long-term objectives, and ultimately because its valuation is a very disputed and interesting topic, leaving no one indifferent, from retail investors to professional financial analysts.

Tesla is an American corporation founded in 2003 and has taken the world by storm over the last decade. With its charismatic co-founder and CEO Elon Musk and a disruptive outlook on the world, Tesla has been captivating millions around the globe with its vision for the future. They are now market leaders in electrical transportation, battery pack production, real-world Artificial Intelligence, and robotics, maintaining a very loyal customer base and, in the extreme, an almost cult of personality around Elon Musk himself.

We are going to commence with a literature review where we intend to analyze the work done by distinguished authors regarding the different methodologies we are using to understand them better. In addition, we will also give insight into work done by noise traders, investment sentiment, company vision, and their repercussions.

Following that, our goal is to give an overall view of the company and macroeconomic factors, the industry it lies in (both electrical and combustion engine car manufacturers), a SWOT analysis, and the future for Tesla.

After scrutinizing all the above-listed factors, we aim to evaluate the company based on three models: Discounted Cash Flow (DCF), Economic Value Added (EVA), and Relative Valuation. We are going to compare the results that we obtained and will compare them with the observed prices in the stock market on December 29, 2023. We aim to provide reasoning behind those observed differences and make a

recommendation based on more than just the models but an overall look at the company and its future. To try and explain the differences, we will use behavioral finance and the impact of noise traders on the price of a stock as well as tackling the misconception that Tesla biggest asset and valuation is from car manufacturing.

We believe that this case study will be relevant to investors since it will not be a binary conclusion (buy or sell) purely based on the models, but a nuanced analysis of a wide range of topics and reasons for a recommendation of buy, sell, or hold.

CHAPTER 1

Literature Review

In this section, we will give an overview of the main literature surrounding the more technical topics that we will discuss and present in the thesis, with the goal of grasping them for future application in our topic.

1.1. Corporate Valuation and Valuation models

Valuation is a key concept of corporate finance and some authors such as Damodaran (2006b) consider it to be "the heart of finance", since it is at the base of every investment or financing decision that individual or corporate investors must make. Given this stated importance, it is imperative for the purpose of this thesis that there is a solid understanding of the different possibilities on how to properly value an asset or a company. It is also of importance to grasp the difference between valuation and price. Price, on the one hand, is the product of market forces, such as supply and demand, at work. In the financial markets, the price of a stock is the monetary amount by which that stock is being traded at any moment in time. Value, however, although not independent from price is not its equal. Value is usually calculated through fundamental analysis, which includes evaluating numerous factors such as earnings, cash flows, prospects of growth, competitive situation and macroeconomic conditions.

It is relatively common for the value given by these models to differ from the observed price in the stock market, and this can occur due to a multitude of factors, such as personal biases in inputs which can be a growth rate prediction. To fight these biases, the introduction of some changes after the valuation process can occur if that bias can be identified. Additionally, if an explanation cannot be found using quantitative factors, the shift is made to qualitative factors. This is an attempt to rationalize the observed difference between price and value and these factors are usually strategically based (Damodaran, 2017).

Every asset or firm is unique and so the results that are obtained by different valuation methods also need to consider that uniqueness. Beyond that, the environment that that firm is in, with the economic landscape and industry that is inserted in, also plays a role in the chosen valuation methodology. With that in mind, the use of several different models and get a grasp for their results, is key in minimizing the importance of the external factors to the assets or company itself.

To value a company several different methods can be used, and each one has its pros and cons relative to one another. There are five main valuation methods. The first one that we will discuss is the Discounted

Cash-Flow connects the value of the company or asset to the value of expected future cash flows discounted to the present time. Following that, the Economic Value Added (EVA) model, intends to assess the ability of a company to generate value to their shareholders. The third and last model that we will use, Relative Valuation, is when the value of a firm is estimated based on the price of similar assets and it is required to standardize the analyzed variable that can be related to earnings, cash flows or revenues. One of the methods that we will not use, the Contingent Claim Valuation, is perhaps one of the most disruptive of the valuation methods. It uses models to price the company's options and by that procedure, it can measure the value of the assets that have similar characteristics as that derivative. We will also not discuss the Dividend Discount Model since Tesla does not pay dividends.

In this subsection, we will focus on the different models used to value a company and what several different authors have to say about their methodologies and applications.

1.2. Discounted Cash-Flow Method

In the Discounted Cash-Flow (DCF) method, the value of an asset or a company is the present value of the expected cash flows on that same asset or company, at which we need to discount back at the rate that best reflects the risk taken by those same cash flows. In this method, the time value of money is of importance, meaning that a specific amount of money in the present day is worth more than that same amount at any point in the future.

According to Damodaran (2006b) there are three main approaches to identify DCF methods of valuation. The first is based on differentiating the value of a business as a going concern and the value of a business as a collection of assets, using Free Cash Flow to the Firm (FCFF) method values the company itself. The second approach makes a distinction between valuing the equity of a business of valuing the business itself, making use of the Free Cash Flow to Equity (FCFE) method values the company's equity. Finally, the third is calculated on the excess returns and the adjusted present value, utilizing the Adjusted Present Value (APV), values the company itself while removing the value of the debt. In other words, the value of a project to a levered company is equal to the value of the same project to an unlevered company in addition to the net present value of the side effects of the financing (Ross, Westerfield, Jaffe, 2016).

1.2.1. Free Cash-Flow to the Firm

The FCFF is the firm approach of the DCF method and is based on expectations about the future growth rate and for how long it is expected to be maintained, the metric that is usually around 5 years (Steiger, 2008). The FCFF is discounted at the Weighted Average Cost of Capital (WACC), which is usually lower than the cost of equity, in order to reach the Enterprise Value (EV) and ultimately compute the Equity Value (EQV). To value a company using this method, the FCFF is portrayed as the amount in the operating cash flow after deducting taxes, working capital (WC) differences and investments directly linked to the company's operating activity. The formula to calculate the FCFF is:

$$FCFF = EBIT\,(1 - t_c) + Depreciations\ and\ Amortizations - CAPEX \mp \Delta WC \qquad (1.1)$$

Where,

- EBIT – Earnings Before Interest and Taxes;
- t_c – Corporate tax rate;
- CAPEX – Capital Expenditures;
- ΔWC – Changes in Working Capital

As explained earlier, we are required to calculate the WACC in order to find the EV. WACC is the discount rate that companies use to estimate their Net Present Value (NPV) and is also very important for decision making. In order to analyze if a company is to enter a new project, if the return is higher than its WACC, then is most likely a good decision. The WACC can so be calculated as:

$$\text{WACC} = \frac{r_E \times \text{E}}{E+D} + \frac{r_D \times \text{D}}{\text{E} + \text{D}} \times (1 - t_c) \qquad (1.2)$$

Where,

- r_E – Cost of equity – required rate of return by equity holders;
- E – Market value of the firm’s equity;
- (E+D) – Total market value of the firm’s financing;
- r_D – Cost of debt – required rate of return by debt holders;
- D – Market value of the firm’s debt.

Cost of Equity

To estimate the WACC, one of the required inputs is the cost of equity. This should be higher as the risk of the investment increases, since the risk should be rewarded with higher returns. The cost of equity is the most difficult WACC parameter to estimate. According to Damodaran (2006b), the difficulty of estimating cost of equity relies on it being an implicit cost, meaning it is a cost that cannot be directly observed. The second reason for this difficulty is that the expected rate of return may not be the same for different investors in the same company, with investors having a wide range of expectations for their returns.

We can estimate the cost of equity by executing the Capital Asset Pricing Model (CAPM). Initially, we need to estimate what is the expected rate of return for the overall market. This can be done using some a weighted average of returns, using an index such as the S&P 500. The second step is to know the risk-free rate, as for that we can use information from US Treasury bills rates. The CAPM has a variety of assumptions according to Damodaran (2002), such as there is a riskless asset which has a guaranteed outcome and investors can lend and borrow at the riskless rate to arrive at their optimal allocations. Additionally, each investor has its preferences in capital allocation, and that decision is correlated with their willingness to take risk, meaning that a risk-averse investor will allocate a larger portion of their investments on a risk-free asset and the opposite occurs for a risk-taking investor. Additional assumptions of the CAPM are that individual investors are price takers and rational, information is costless and available for all investors as well as no transaction costs and homogeneous expectations.

Any individual asset adds a certain amount of risk to an investor's portfolio. In the CAPM, if the additional asset is independent of the market portfolio, it will add zero to no risk to it, meaning that the risk that it presents in this situation is a firm-specific risk. In the opposite direction, in the case of correlation between the asset and the market portfolio, this asset will increase the risk to the market portfolio, meaning it has more market risk and less firm-specific risk. We can measure this additional risk by the covariance of the asset with the market portfolio divided the variance of the market index's returns, also known as beta and our final input for the cost of equity.

$$r_E = r_f + \beta(r_M - r_f) \tag{1.3}$$

Where,

- r_f – Risk-free rate;

- β – Company's beta;
- (r_M - r_f) – Market risk premium.

Risk-Free Rate

The risk-free rate is the rate of return of a risk-free asset. We can assert such an asset as one that will deliver its return with certainty. For that to be a reality, two conditions must be met: The first is that the risk of default must be non-existent, meaning that is usually issued by a government, specifically a government of a stable and wealthy country. The second is that the reinvestment rates cannot have any uncertainty, meaning that on a larger time horizon than that of the original investment, there might be some uncertainty over the larger time scale return rates.

The risk-free rate is a key element of not only the cost of equity but also the cost of debt, which we will discuss shortly. In the case for the cost of equity, an increase in the risk-free rate leads to a decrease in the cost of equity if the beta is larger than 1. While in the cost of debt, the same effect in the risk-free rate leads to a decrease in the cost of debt, however that same effect would cause a decrease in the present value of the company's cash flows.

According to Damodaran (2008), it is also important that the risk-free rate be consistent with the cash flows being discounted. In particular, the currency in which the risk-free rate is denominated should be determined by the currency in which the cash flows are estimated.

Calculating the risk-free rate is, theoretically, the expected return on a portfolio with a beta of zero, however the calculation of that rate using this method can be quite challenging. So, in alternative, we will utilize rates of securities with inexistent default risk, such as debt of the United States government.

Market Risk Premium

As we already presented, the market risk premium is the difference between the expected return of the market and the risk-free rate, and is what investors require for shifting their capital from a riskless asset, such a government bond, to an average risk investment, such as an index.

For the estimation of risk premiums, there are three different ways of estimating them (Damodaran, 2006b) in the CAPM. The first that we will address is to make use large investors can be utilized to gain information about their future expectations, since it is impossible to survey all investors and that their average of premium required will be the market premium, the solution is to take a meaningful sample

(large investors) and deduce the result of the population. Secondly, the premiums that were gained over a past period can be acquired from historical data, meaning that the premium is calculated as the difference between average returns on stocks and average returns on risk-free securities over an extended period of past time. The third and last approach is the implied premium can be acquired from current market data, and this can be done by using data from expected cash flows and stocks to estimate the premium.

The market risk premium is specific for each company, and that can be calculated by multiplying the overall market risk premium by the firm's common stock beta. The overall market risk premium is around 5%, according to estimates during most of the 20th century.

Beta

In the Capital Asset Pricing Model, a firm's beta is a measure of its systematic risk, meaning that is the risk associated with the entire market or a segment of it. Since it is not tied down to a particular stock, this is a non-diversifiable risk. To estimate the beta, it needs to be relative to the market portfolio, meaning that the S&P 500 has a beta of 1.0 and the higher the beta the higher is the company's volatility. It can be calculated by dividing the product of the covariance of the security's returns and the market's returns by the variance of the market's returns over a specified period. (Damodaran, 2002)

$$\beta = \frac{\text{cov (Stock,Market)}}{\text{var (Market)}} \tag{1.4}$$

Cost of Debt

The final part of the WACC formula that we stated earlier is the cost of debt, which can be described as the effective interest rate of the debts of the firm. As the perceived default risk increases, the default spread required by the loaners will also increase. The cost of debt can therefore, be calculated as the sum between the risk-free rate and the default spread.

$$r_D = r_f + Default\ Spread \tag{1.5}$$

The risk of default is measured as the consequences of the risk of a specific company failing to meet certain requirements, such as promised returns. It is a function of two distinct variables (Damodaran, 2006). The first of these variables is the company's ability to generate cash-flows from operating activities and the extent of its financial obligations, meaning that firms that can generate high cash flows in relation to their financial obligations, have a lower default risk and vice versa. The second variable regards the

volatility of the cash flows, meaning that stability and consistency of these cash flows will also lead to lower default risk, meaning a lower default spread and ultimately a lower cost of debt.

In order to estimate the default spread, the most common method is by using bond rating, usually issued by rating agencies, such as Standard & Poor's and Moody's. This results in the fact that the higher the rating, the lower is the default spread, since the market recognizes value in their analysis. In the case of companies that are not rated, such as small and private firms, the two main ways to estimate the default spreads are by looking at their borrowing historical data or by attributing a rating without the involvement of the rating agencies. This second one requires an extensive financial analysis of the firm, and the Interest coverage ratio is usually used. To give a better understanding of the default spread ranges, a AAA company usually has a spread around 0.35% while a D company has a default spread of around 20%. This default spread is added to the risk-free rate, usually set as US Treasury Bills.

Enterprise Value

In the FCFF approach of the DCF methodology, the enterprise value is the present value of the of a project's expected cash flow. So, this is calculated by discounting the future cash flows that will be generated by the company at the Weighted Average Cost of Capital (WACC). For the first years, we can say 7 to 10, which is the time interval required to have a stabilization of cash flow growth, the FCFF for each of those years is used. After that time horizon, the Terminal Value is calculated, a topic that we will approach after. So, the Enterprise Value (EV) is calculated as:

$$\text{EV} = \sum_{t=1}^{t=n} \frac{FCFF_t}{(1 + \text{WACC})^t} + \frac{TV_n}{(1 + \text{WACC})^n} \quad (1.6$$

Where,

- $FCFF_t$– Free Cash-Flow to the Firm in the time period t, period=1 to n;
- TV_n– Terminal Value at the end of the time period n
- WACC- Weighed Average Cost of Capital

Terminal Value

"The terminal value is the value of the company in year t as if it were to be sold in year t" (Larrabee D. T., & Voss, J. A. 2013). The Terminal Value is key in the DCF Model since it will be utilized in the Continuity Value that can be responsible for a significant portion of the Equity Value. To calculate it, the main unknown variable at this point is the Terminal Growth Rate (g). To estimate g, we must consider the inflation rate as

well as the specific company being studied. We need to add both these variables and reach a conclusion for the Terminal Growth Rate. Additionally, the characteristics of the firm must be consistent with assumptions of stable growth. In particular, the reinvestment rate used to estimate free cash flows to the firm should be consistent with the stable growth rate.

$$TV_n = \frac{FCFF_{n+1}}{\text{WACC} - \text{g}} \tag{1.7}$$

Where,

- g – Growth rate.

Now we can substitute the Terminal Value in the Enterprise Value equation, leaving the EV calculation as:

$$EV = \frac{FCFF_1}{(1+WACC)^1} + \frac{FCFF_2}{(1+WACC)^2} + \frac{FCFF_3}{(1+WACC)^3} + \dots + \frac{\frac{FCFF_{n+1}}{WACC-g}}{(1+WACC)^n} \tag{1.8}$$

Equity Value

Equity Value (EQV) is the value of a company available to owners or shareholders. It is the enterprise value plus all cash and cash equivalents, short and long-term investments, and less all short-term debt, long-term debt and minority interests.

$$EQV = EV + Non\ Operating\ Assets - Net\ Debt - Minority\ Interest \tag{1.9}$$

Non-Operating Assets are the assets that are not considered to be part of the main business operations of firms, such as cryptocurrency investment by a car company. Net Debt is a liquidity measure that determines how much debt a company has on its balance sheet relative to its cash on hand. Lastly, Minority Interest is an ownership stake in a corporation that is less than 50%. This portion is held by an individual or collective that is not the parent company or the main participants of the business.

After the calculation of EQV, we can estimate the fair price per share. We can do this by dividing EQV by the number of outstanding shares.

1.2.2. Free Cash-Flow to Equity

The second way of using DCF valuation besides the FCFF is using the Free Cash Flow to Equity (FCFE), which is the cash flow that is available to the company's equity holders only. Warren Buffett, for instance, has argued the point "that investors should judge companies based upon what he called "owner's

earnings", which he defined to be cash flows left over after capital expenditures and working capital needs, a measure of free cash flow to equity that ignores cash flows from debt".

$$FCFE = Net\ Income + Depreciations\ and\ Amortizations - CAPEX \mp \Delta\, WC + New\ Debt\ Issued - Principal\ Repayments \tag{1.10}$$

By doing this, we can now deduct the EQV using this variant, since the Enterprise Value is the same as the Equity Value. So, we can compute EQV as:

$$\text{EQV} = \sum_{t=1}^{t=n} \frac{FCFE_t}{(1 + r_E)^t} + \frac{TV_n}{(1 + r_E)^n} \tag{1.11}$$

Where:

- $FCFE_t$– Free Cash-Flow to Equity in the time period t, period=1 to n;

Knowing that,

$$TV_n = \frac{FCFE_{n+1}}{r_E - \text{g}} \tag{1.12}$$

Thus,

$$\text{EQV} = \frac{FCFE_1}{(1 + r_E)^1} + \frac{FCFE_2}{(1 + r_E)^2} + \frac{FCFE_3}{(1 + r_E)^3} + \ldots + \frac{\frac{FCFE_{n+1}}{r_E - g}}{(1 + r_E)^n} \tag{1.13}$$

After these calculations, we can then divide the EQV value for the number of outstanding shares, in order to reach the required number of value per share.

1.2.3. Adjusted Present Value

The Adjusted Present Value (APV) is a two-part method. First, we estimate the value of the company with no leverage, meaning that equity is the firm's only source of financing. After that, we consider the present value of the interest tax savings generated by borrowing a given amount of money. Even though we said that this will be a two-part method, a third does exist, however is so difficult to properly estimate that we will mention it in the literature review but will not be used further in the thesis. This third component is to make an evaluation of the consequences of borrowing a given amount on the likelihood that the company will default, and the expected cost of that bankruptcy. So, the formula to calculate the APV is:

$$APV = V_U + PV\ (Tax\ Shields) - PV\ (Expected\ Costs\ of\ Bankruptcy) \quad (1.14)$$

Being:

- V_U – Value of Unlevered Firm.

First, we need to be able to calculate the Value of Unlevered Firm, that measures only the value of a company without its debt, and we can do that by:

$$V_U = \frac{FCFF_0\ (1+g)}{r_U - g} \quad (1.15)$$

Where:

- FCFF0 – Current after-tax operating cash-flow to the firm;
- r_U – Unlevered cost of equity.

We then require calculating the unlevered cost of equity to find the Value of Unlevered Firm, and we do that by using the following CAPM formula:

$$r_U = r_f + \beta_U(r_M - r_f) \quad (1.16)$$

Where:

- β_U – Company's unlevered beta.

To calculate the company´s unlevered beta, we require the levered beta, which can be calculated by using the asset price (stock).

$$\beta_U = \beta_L \times \frac{E}{V} + \beta_D \frac{D(1-t_c)}{V} <=> \beta_L = \beta_U + (\beta_U - \beta_D)(1-t_c)(\frac{D}{E}) \quad (1.17)$$

Where:

- β_L – Company's levered beta;
- β_D – Company's debt beta

We now move towards the calculation of the second step, the present value of the interest tax savings generated by borrowing a given amount of money or Present Value of Tax Shields. This tax benefit is a function of the tax rate and interest payments of the firm and is discounted at the cost of debt to reflect the riskiness of this cash flow (Damodaran, 2002). It can be computed by this formula: (1.18)

$$\text{PV Tax Shield} = \sum_{t=1}^{n} \frac{r_D \times \text{D} \times t_c}{(1 + r_D)^t} \quad (1.18)$$

The final step in this process is to evaluate the effect that a given amount of debt can have on the default risk of the company and on the predicted bankruptcy expenses. We can do it by applying the following formula:

$$PV\ Expected\ Costs\ of\ Bankruptcy = \pi_a \times BC \quad (1.19)$$

Being:

- π_a – Probability of bankruptcy;
- BC – Bankruptcy costs.

The estimation of the probability of bankruptcy poses the most problems and can be estimated indirectly in two distinct manners. The first is by using a bond rating and by extrapolating a default probability. The second one, is to use a more statistical approach in order to estimate the probability of default, basing those estimates on the unique characteristics of the firm.

1.2.4. Economic Value Added

Economic Value Added (EVA) is a measure of a company's financial performance and is the incremental difference between the rate of return of a firm and its cost of capital. EVA is often slated as economic profit, used to measure the value a company can generate from the capital that is invested in. This valuation method suits companies that have an abundance of quantifiable assets, but on the other hand, has flaws when it comes to value companies that have intangible assets, such as technology-based firms. To calculate the Economic Value Added we use the following formula:

$$\text{EVA} = \text{NOPAT - (Invested Capital} \times \text{WACC)} \quad (1.2)$$

Where:

- NOPAT = Net operating profit after taxes
- Invested capital = Fixed Net Assets + Working Capital
- WACC = Weighted average cost of capital

Besides that, we also know that:

$$ROIC = \frac{\text{NOPLAT}}{\text{Invested Capital}} \tag{1.21}$$

Therefore, we can now calculate Economic Value Added as:

$$EVA = (ROIC - WACC) \times Invested\ Capital \tag{1.22}$$

As per (Larrabee & Voss, 2013), the Market Value Added (MVA) is closely related to EVA and can be calculated as the difference between the company's enterprise value and its invested capital or as dividing the economic profit with the cost of capital. We can then calculate it as:

$$\text{MVA} = \sum_{t=1}^{n} \frac{EVA_t}{(1 + \text{WACC})^t} \tag{1.23}$$

$$EV = MVA + Invested\ Capital \tag{1.24}$$

Ultimately, we can use this knowledge to compute the Equity Value using the following formula:

$$EQV = EV + Non\ Operating\ Assets - Net\ Debt - Minority\ Interests \tag{1.25}$$

1.3. Relative Valuation

In Relative Valuation the goal of the analysis is to estimate the value of the firm's assets, based on how similar assets are priced in the rest of the market. There are two components in this methodology, being the first the need for standardization through the conversion of price to ratios or multiples based on sales, earnings or book value. Then it is required to find a similar firm, something that is no easy task, since each firm has its own unique characteristics.

This valuation has become increasingly popular, mainly for two distinct reasons. First, it is far simpler and faster than the discounted cash flow valuation. Second, it is also much simpler to both interpret and present to a third-party observer. However, some of its strengths can also be its weaknesses. The relative ease in the ability to put together a multiple and group of comparable firms, can lead to incomplete and inconsistent results.

There are several different types of multiples, and they are revenue, earnings and book value. The first has examples such as the price-sales ratio, where the market value of equity is divided by the revenues. Earnings multiples can be such as EV/EBITDA or EV/Revenue and are mainly focused on the valuation of the firm. The third type, book-value multiple, can be such as the price-book value, that measures the relationship between the price they pay for a stock and the book value of equity (as a measure of how poorly valued a stock is). Additionally, there are also Sector-Specific Multiples which are not as common as the ones that we previously exposed, but that are specific to a single industry and can be of note if properly utilized.

One of the most commonly used valuation multiples is the price-to-earnings (P/E) ratio. It can be computed by the dividing stock price by earnings per share (EPS), and it can be interpreted as a company's share price as a multiple of its earnings. A company with a high P/E ratio is trading at a higher price per dollar of earnings than its competitors and is considered overvalued. Per the same thinking process, a company with a low P/E ratio is trading at a lower price per dollar of EPS and is considered undervalued.

1.4. Real Options

Options are financial derivatives that give the holder of the contract the possibility, not the obligation, to buy or sell an underlying asset at a predetermined price within a specified period. Real options extend these contracts to different underlying assets and instead of those being financial instruments, such as stocks, the underlying is a real asset (real estate or commodities). The term real options first appeared in 1977, by the hand of Stewart Myers, and as he broke it down, the value of a company can be divided by two main components: the observed results and growth opportunities. It recognizes that managerial decisions often have embedded options that can affect the value of these assets. Real options analysis allows for the valuation of flexibility or strategic opportunities associated with investments, such as the option to expand, defer, or abandon a project based on future uncertainties.

Company valuation using real options can be particularly useful, when compared to other methods such as the DCF, because it considers the flexibility that these contracts present (Larrabee & Voss 2013). When valuing certain firms that might have some competitive advantage over other companies, they have an increased flexibility in price, market introduction and delivery. These advantages cannot be measured by other models. Nevertheless, it is important to understand that Real Option Valuation does not substitute other valuation methods, but instead is a complement to them.

1.5. Investor sentiment and behavioral finance

The effect of human behavior and narrative in the firm or asset valuation scenario has been increasingly studied in corporate finance. The objective is to attempt to better understand the impact of human psychology in investment decision making.

It is important to understand that not everyone is the same, and there are two main schools of thought on this topic (Damodaran, 2017). Some people are fully rational and only consider financial statements and already realized results and everything else is a "fairy tale". On the other hand, there are people who value not just the numbers that they see and analyze, but also potential, mission, values and overall narrative. The analytical side is usually more prevalent in bond-like investments, such as actual bonds or indexes (Damodaran, 2017). Conversely, narrative driven investors are usually stock investors and are usually more risk taking. Both approaches have their pros and cons, but as we have already focused on valuation models, we will dive mainly on the less analytical side of this spectrum.

For investment sentiment to truly supersede the objective analysis of a company, the message must have several distinct characteristics, such as (Damodaran, 2017):

- **Simplicity** – A story that is way too complex for the general public to comprehend, will leave the general public lacking interest in it.
- **Credibility** – It is key to captivate the possible investors by achieving minor but important goals along the way to the advertised destination. Otherwise, people will not fully take their word as true.
- **Inspiration** – When defining the ultimate goal for a company, it is important to be aligned with what the investors and the population in general can rally behind, leaving them with a natural willingness to invest and see the firm succeed.
- **Actionable** – After the captivation of the investors, it is now needed to give them the ability to monetize their desired action, meaning they must be able to buy stocks and derivatives as well as see the prospect of a profit. They might be more risk tolerant, but at the end of the day, investors need to see return.

It is also very important to comprehend that narratives are much more sensitive and fragile than an analytical approach, since these are usually not fully supported on facts and data but on personal perception instead. There are an array of causes and reasons that can make the public perception shift towards a company, with examples as: the inability to transform theory to practice, the entrance of

competition within the industry that can “sell” just as good or even better and external events such as economic crisis or armed conflicts.

A period of extraordinary investor sentiment pushed the prices of speculative and difficult-to-value technology stocks to unfathomable levels in the late 1990s. Instead of creating opportunities for contrarian arbitrageurs, the period forced such investors out of business, as prices that were merely high went higher still before an eventual crash, signaling the dangers of extreme cases of sentiment investors.

Figure 1. Effect of Investor Sentiment on Stock Valuation. Malcolm Baker and Jeffrey Wurgler. 2007

In this graphical representation (Figure 1) of investor sentiment across different types of stocks, it is clear to observe that as the speculation level increases, so does the value of a high-sentiment stock valuation.

An additional point that we seek to make is the existence and impact of noise traders. A noise trader is a term that intends to describe an investor who makes decisions based on incomplete or inaccurate information, also known as “noise”. One of the various reasons, but perhaps the most common, that noise traders act is the existence of sentiment causing a rift between the price and value of a stock. At times, the impact is so great that rational investors are incapable of balancing the scales and offsetting the imbalance caused by the traders.

CHAPTER 2

Company Overview

2.1. Description

Tesla, Inc is an American multinational corporation that is most known for leading the transition to clean and renewable energy storage and transportation, mainly the production of electric cars. The company's headquarters is in Austin, Texas and has over 127,000 workers in their ranks. Tesla has seen exponential growth in the last few years and is shaped to continue to grow and shape the world we live in.

Tesla is a component of several different indexes, most notably, NASDAQ, NASDAQ 100 and S&P 500, being the most valuable automaker in the world, valued at $790 billion as of December 29, 2023. The company went through 2 stock splits over the years, one in August 2020 on a 5-1 ratio and 2 years later, in August 2022 on a 3-1 ratio. This measure was taken mainly, according to Elon Musk, to help recruit and maintain skilled staff. This is because it provides Tesla employees more freedom to manage their ownership through compensation plans or stock purchase plans.

Tesla has a 4% market share of vehicles in the US/Canada and slightly below 3% in Europe, presenting and year over year (YoY) revenue growth of around 40%.

The company's ultimate goal and ambition is to "to accelerate the world's transition to sustainable energy" while providing the best possible goods and services required to make that happen.

Figure 2. Tesla Vehicle Market share per region. Tesla quarterly shareholder meeting

2.2. History

Tesla, Inc. is an American company founded on July 1, 2003, by Martin Eberhard and Marc Tarpenning in California as Tesla Motors, and its name is in honor of inventor and engineer Nikola Tesla, famous for his electrical engineering inventions. Eberhard said he wanted to build "a car manufacturer that is also a technology company", with its core technologies as "the battery, the computer software, and the proprietary motor".

In February 2004, Tesla raised a total of $7.5 million, of which $6.5 million came from Elon Musk making him the company's largest shareholder. In 2006 the first car, the Roadster, an electric sports car,

was revealed and production began in 2008. The early production of this model was done at a former Chevrolet dealership in Menlo Park, California. Back in 2007, Eberhard stepped down as CEO, at the request of the Elon Musk led board. By 2008, both founders, Eberhard and Tarpenning would no longer be in the company, and Elon Musk had become Tesla's CEO.

In 2009, the Department of Energy awarded a $465 million loan to Tesla, as part of a much larger plan to develop advanced vehicle manufacturing in the United States of America, and really propelled the development and production of the Model S sedan. The loan was fully paid back by 2013 with $12 million in interest.

The following year, 2010, was a major year for the company. In May, Tesla acquired a factory in Fremont, California from Toyota for $42 million and it opened later that year, in October. Back in June, the company went public via an Initial Public Offering (IPO), and it was the first IPO from an automaker since Ford Motor since 1956. Tesla managed to raise $226 million, by issuing 13.3 million shares at $17 per share.

In 2012, the production of the Roadster stopped, and Model S became available to the public, becoming a success for Tesla when it was the most sold car in Norway for a month, making it the first electric car to ever top the monthly sales leaderboard of a country. In the same year, a major infrastructure necessity for the proliferation of electric vehicles was introduced, the Tesla Supercharger, a fast-charging port with worldwide locations.

In 2014, Tesla started showing the first signs of their true long-term ambitions, to not only accelerate the transition to sustainable transportation and energy production, but also in advanced software, Artificial Intelligence (AI) and robotics. The announcement of the Tesla Autopilot and later in the year, the installation of software and sensors to support it, were included in all cars that were shipped from that point forward. In addition, Tesla realized that one of the main constraints of sustainability was the inability of energy reserves and conservation, and so they unveiled the Tesla Powerwall and Tesla Powerpack in April 2015, as battery packs. In September of the same year, the SUV Model X began shipping.

Yet another evidence for Tesla's ambitions beyond car production, was the acquisition of SolarCity for $2.6 billion in November 2016. SolarCity, as the name suggests, was a company specialized in the sale and production of solar energy hardware and services and was acquired to substantially increase Tesla's capability of existing battery energy storage products. Additionally, in October 2016, Full Self Driving (FSD) was first introduced to the public, with the intent to make self-driving cars that went way over the Autopilot's capabilities and intended to make drivers a thing of the past.

Earlier, in April 2016, Tesla presented their first vehicle made for the masses, the Model 3 sedan. This implied a shift from the previous luxury models, and introduced ground-breaking production methodologies, backed by robotics and automation. This strategy backfired in the short term because of problems with the production line. During this crisis, Tesla became one the most shorted companies in the market, creating an additional financial pressure on the then struggling company, but by 2018 the problems were resolved, and the Model 3 went on to become the best-selling electric car until 2021.

During the second half of 2019 and the first half of 2020, Tesla reported four consecutive quarters with profits, making the company eligible to be included in the S&P 500, being added on December 21, 2020. During the full year of 2020, Tesla stock price rose 740% and in January 2021 it reached a market capitalization of $848 billion, making it more valuable than the other 9 largest automakers combined. In November 2021, Tesla hit its peak valuation of over $1.1 trillion.

In March 2019, Tesla announced their second vehicle intended to be mass produced, the Model Y, with deliveries starting 12 months later. To support the new model and the exponential growth in sales, the company would build three new factories, Gigafactory Shanghai, Gigafactory Texas and Gigafactory Berlin-Bradenburg, with production on all three having started by April 2022. Ultimately, an additional one is set to be ready for production in Mexico by 2025.

In yet another display of diversification, in August 2021, Tesla announced Optimus, also known as Tesla bot, which is a robotic humanoid with the goal of leveraging the work of the company in AI from the FSD project to power Optimus to perform real life tasks, making Tesla one of the world's leaders in real world artificial intelligence. This intends to be a mass-produced and cheap robot that promises the way we interact with our mechanical counterparts. For the past few months, Tesla has been sharing a few videos from Optimus and even though they are still behind robotic companies like Boston Dynamics, their progress pace is staggering. Additionally, the start of the production on Dojo, a supercomputer designed and built by Tesla for computer vision video processing and recognition. It will be used for training Tesla's AI models to improve its Full Self-Driving (FSD) system.

Tesla, Inc. which started as this dream of accelerating the transition to renewable energy, is now the leading fully electric car manufacturer in the world (only behind the Chinese company BYD worldwide if hybrids are considered), the leader in battery pack production, robotics and AI, with the vision of changing the world as we know it. In addition, it now has a market capitalization of $790 billion making it the sixth most valuable company in the S&P 500.

2.3. Products and services

In this part, we will provide an overview of the main products and services that Tesla either already offer or that are relevant to the near future and are significant for the overall view of the company´s vision and future.

2.3.1. Vehicles

We have previously had a brief introduction to the history of the several vehicles produced by Tesla over the years, however, we will now take a closer look to past, present and even future vehicles. The original car manufactured by Tesla was the Roadster. First revealed in 2006, an all-electric sports car, was made available to the general public in 2008 and production stopped in 2012, selling an overall of 2450 cars.

After the Roadster, came the Model S, a luxury Sedan that began production in 2012 at the Fremont, California factory and became the first electric car to top the monthly sales ranking of a country, when it achieved first place in the Norwegian new car sales list in September 2013. It was also the bestselling plug-in electric car in the world for both 2015 and 2016.

In 2015 the third vehicle that Tesla developed was the Model X, a luxury SUV and still to this date is only produced at the Fremont plant. Being a luxury car, the 2023 Model X starts at $80,000, and for that reason sells a much smaller level of cars, and suffered even more with the introduction of the cheaper Model 3 and Model Y. In the entire year 2023, the combined sales of the Model S/X were only 68,000 units.

In 2016, the presentation of the first vehicle with the intention to be mass produced, the Model 3. It is a sedan and within a week Tesla received over 325,000 paid reservations. This vehicle was an absolute game changer, by being able to reconcile affordability, estheticism, practicability and performance. This led to the Model 3 being the first electric car to pass global sales of 1 million units in June 2021.

Tesla’s crown jewel is the Model Y, which started production in 2020, a mid-size SUV that was also intended to be mass produced. It is currently produced in California, Shanghai, Berlin and Texas. In 2023, it was the world's best-selling vehicle and was the first electric car to get that title. During that period, Tesla sold over 1.2 million Model Y’s.

Finally, Tesla´s last available vehicle is the Cybertruck. Announced in 2019 and finally started deliveries in November 2023 only in North America. It is a futuristic looking pick-up truck and as of late 2023 it has over 2 million orders.

Besides the already discussed projects, some additional upcoming ones are of relevance. The first is the Tesla Semi, a fully electric cargo truck, being finalized in early 2023 but due to battery cells shortage, it should only reach the public by 2024. Another one is the second-generation Roadster, Tesla's supercar which should be for sale in 2025 and has a price tag of over $200,000. Finally, the most important future vehicle for Tesla is by far their first low-cost vehicle, codenamed Redwood, it can be not only massive for the company but also for the proliferation of electric vehicles. The capture of the $20,000/$30,000 market can truly take Tesla to yet to achieve heights.

Figure 3. Production Capacity for each Model per factory. Tesla quarterly shareholders meeting

As shown in Figure 3, the installed annual vehicle capacity is significantly over 2 million units per year which is a remarkable advance from the 2450 Roadsters in the four years between 2008 and 2012.

2.3.2. AI, FSD and Robotics

As previously stated, the biggest asset of Tesla is very hard to value and quantify, and that is its FSD. We already concluded that they are almost unmatched in this pursuit and would even be open to allow access to this system to other automakers, which reflects their confidence in its competitive advantage. This program intends to create a self-driving car and was introduced in 2013 as an auto-pilot system and made available to the public in 2014. By 2019 it comes as standard in every Tesla vehicle. In 2016, Tesla decided to take it to another level, announcing a full self-driving system but only in 2020 released their first beta version to be downloaded by users. These delays were mainly because Tesla realized too late that their initial direction was the wrong one, and so in 2021, they shifted the FSD program from logic programing to end-to-end neural nets. It uses lasers and cameras all around the vehicle to recognize its surroundings and make decisions based on what those sensors collect. The system will be open to more and more people, something that is key, because the neural network system needs millions of hours of footage to learn how to recognize patterns.

Figure 4. Cumulative miles driven with FSD Beta. Tesla quarterly shareholders meeting

This figure (Figure 4) shows the exponential growth of miles driven with FSD, a key metric to the development of the program, and that is because at the base of every AI program, great amounts of data were collected and analyzed in order to train the model. The service is available, as of September 2023, for

every Tesla owner with a FSD computer equipped in North America for either $15,000 up-front or a $200 monthly subscription and is currently actively used by close to 400,000 people.

With all the data pouring into Tesla, the company is forced to have incredible amounts of computing capability in order to maximize it. This requires an immense investment in the purchase of CPUs and GPUs, mainly from Nvidia, and due to the increase in other AI systems in the world, this hardware price is at an all-time high. Consequently, Tesla announced in 2021 the Tesla Dojo, which is a supercomputer designed from the ground up by Tesla for computer vision video processing and recognition. It will be used to train Tesla's machine learning models to improve FSD.

Figure 5. Cumulative miles driven with FSD Beta. Tesla quarterly shareholders meeting

This graphical representation (Figure 5) of computing power shows a projection of having one of the top-5 supercomputers in the world and 100 Exa-Flops (100*10^18) by the end of 2024. An Exa-Flop is a measure of performance for a supercomputer that can calculate at least one quintillion floating-point operations per second and for comparison an iPhone 13 has 11 teraflops (11*10^12).

Lastly, the final major noteworthy non-vehicle project from Tesla is Optimus or Tesla Bot. Optimus is a humanoid robot that uses the core AI system developed by the FSD data and Tesla Dojo/Nvidia computing power to culminate in an advanced AI system capable of understanding the world that we live in. This program is still very young and complex and the first prototype was unveiled in 2022. In the course of 2023, several improved models were shown to the public, where Optimus is performing new activities including folding laundry, sorting-colored blocks by color, its ability to locate its limbs in space and demonstrating its flexibility by maintaining a yoga pose. Tesla intends to produce millions of these robots, and even use them in their factories to build cars or even more robots. This is a project to keep a very close eye on the years to come, having the potential to change the way we live our lives.

2.3.3. Supercharging Network

The icing on the cake for Tesla and one of the many, but perhaps the most important competitive advantage in the current automotive industry, is their Supercharging network. This internally developed system allows Tesla vehicles to be charged almost as efficiently as a combustion engine car fills its fuel tank. In 15 minutes, it allows over 300 km of range and as of December 2023, there are over 50000 connectors, registering a 33% year-over-year growth. Without this system and its proliferation, it is almost impossible for someone to own an all-electric car without a second one with a combustion engine, because every time

a longer trip is needed, the charging infrastructure would be lacking. This is such a disruption in the industry that competitors such as Volkswagen, General Motors and Mercedes-Benz are forced to change their charging ports to Tesla's, to be able to use their supercharging network, subject to an agreement with Tesla. This also shows that for Tesla, not only mission that supplants profit, but that they are so confident in their product, that they are willing to give up some of their competitive advantage, by licensing it to be used by other automakers. This is an ever-evolving technology that will continue to improve as resources are allocated to do so.

Figure 6. Evolution of profitability of Services & Others. Tesla quarterly shareholders meeting

The figure (Figure 6) shows that the introduction of this technology was very financial stressing on the company, with a gross margin on it of -43%, making it clear that they truly believed in the system and were willing to lose money for years, until finally at the end of 2022, their services were finally profitable, and these range from vehicle maintenance to their superchargers.

2.3.4. Battery and Energy

Perhaps the most neglected facet of Tesla´s business is its energy side, both production and storage. The main product of note here is the Powerwall, an energy storage system that is better in tandem with solar power, so it can be independently run from the main grid in case of power outages. These solar panels are also something that Tesla can provide.

Additionally, Tesla's Megapack and Powerpack are designed as massive energy storage systems for large scale operations. As the world shifts towards renewable energy sources, that same energy has different inputs across time (solar in daytime vs nighttime) but must remain steady on its output, so storage during periods of excess, for the future availability in periods of scarcity, is absolutely key.

Figure 7. Energy Storage Capacity across time. Tesla Quarterly shareholders meeting

As in almost every other aspect of Tesla's business, the Energy sector is also experiencing exponential growth. This can be graphically observed in Figure 7 and by analyzing it, we can see that in 2018, their energy storage capacity was at around 1 Gigawatt-hour (GWh), skyrocketing to around 15 GWh as of 2023. This is as Year-over-Year (YoY) growth rate of approximately 72%. For some better sense of scale, 1 GW represents roughly 100 million LED light bulbs or 310 Utility-Scale Wind Turbines. These are very significant

scales, but will soon be made almost insignificant if their growth rate maintains a similar path with the one that is being followed right now.

CHAPTER 3

Macroeconomic Trend

3.1. Gross Domestic Product

For this analysis, we shall discuss some of the most relevant events that happened in the years prior to the date being scrutinized. First, the best measurement for tracking and analyzing macroeconomic trends over the years is the Gross Domestic Product (GDP). GDP is the standard measure of the value added through the production of both goods and services in a country or region during a determined amount of time. It is then, a measurement of the income obtained from that same production, disregarding imports. The graph below (Figure 8) depicts the annual percentage change in real GDP growth for Tesla's three main regions, North America, Europe and China as well as the World.

Figure 8. Real GDP Growth. Source: IMF World Economic Outlook, April 2023.

Taking an analytical view of the graph displayed above and taking particular interest from 2015 onward, the obvious standout feature is the massive drop in 2020. This phenomenon is due to the Covid-19 pandemic that shocked the world and put it at a standstill, causing severe decreases of up to 5% of GDP in North America and slightly less in Europe, but only around 3% in China. As for the World, it mainly followed the path of North America during the pandemic. This is followed by a recovery in the following year, but it can be observed that in China that recovery is much less predominant (around 5%) since they took much longer to fully open their economy than the western countries, which managed to have a 10% increase in their GDP in 2021. It also who noting that for the past few decades, China has been growing much faster than the western economies as well as the global average. However, predictions suggest a GDP growth rate convergence in the years to come, particularly of China and the Globe in the 4% range, something observed in the figure above.

3.2. Inflation

The few years leading up to 2023 have been severely impacted the economic phenomenon of Inflation. Inflation is the generalized increase in prices of both goods and services, measured as the Consumer Price Index (CPI) resulting in the loss of purchasing power over time. This loss of purchasing power impacts the cost of living for the common public which ultimately leads to a deceleration in economic growth.

Figure 9. Inflation rate. World Bank Group, December 2023

This inflationary pressure reached values way above the ones targeted by the major Central Banks around the world at 2%/3% per annum from 2021 onward. This spike was initially caused by the Covid-19 pandemic, which caused a shortage of certain goods, decreasing its supplies and, therefore, increasing the prices. One of such examples is the major disruption in the supply chain of computer chips and semiconductors in China, which caused a shortage in several electronic devices around the World, such as televisions, gaming consoles and smartphones. This disruption was particularly impactful on the Tesla case since they have a factory in China as well as a very software driven product, highly reliant on chip technology. North America experienced a 7.9% inflation while Europe got the worst of the rest, with an inflation rate of nearly 9% and the World met in the middle at around 8.7%. Meanwhile, China, due to its strict anti-Covid policies, managed to escape these pressures but at a massive cost to the Chinese economy.

Figure 10. Industrial Producer Price Index Overview. Eurostat

Another major driver for inflation is the cost of power and electricity. This problem was felt mainly in Europe, particularly in countries that were highly dependent on Russian Oil and Natural Gas, and for that reason is the main focus of our analysis. The very serious restriction on the supply of Russian commodities is due to the Russian invasion of Ukraine in February of 2022, and the sanctions applied to them by most western countries. This scarcity, resulted in either a shortage of commodities or the need to find different suppliers, both lead to an increase in the price of energy and fuel. In the 21st century, very few if any industry is completely immune to energy price fluctuations, causing a widespread cost-push inflation throughout the entire economy. In little over a year, energy prices rose over 50% in the EU and almost 70% in the Union's domestic market, being these increases major inflation drivers, as well as decreasing residents of real purchasing power. Such disruptive values help explaining why the EU had the worst inflation values post pandemic, since it had a second major cost-push inflation crisis immediately following COVID-19.

CHAPTER 4

Competition

4.1. Industry

In this subsection, we will discuss Tesla's main competitors and the industry, and how they stack up against each other. For that, we will select two different automakers, one more traditional, Ford Motors and the other as part of the electric vehicle surge, BYD. Additionally, we will compare one of Tesla's main assets, its Full Self Driving project, with what its competitors are doing in the pursuit of self-driving vehicles.

Figure 11 and 12. Tesla's YoY Revenue Growth and Operating Margin compared with the market. Tesla quarterly shareholder meeting

First an analytical comparison with the entire auto industry. We can clearly see in the graphs (Figure 11 and 12) above that the year-over-year revenue growth has been fantastic for Tesla. Even though they are in an earlier stage of development than the remaining industry or economy, a strong growth in revenue is absolute key for success. It was as high as over a 70% growth on the first quarter of 2022, compared to the auto industry average of 10% and a slightly higher value for the S&P 500. The operating margin, which is the percentage value of profit that a company makes on a dollar of sales after deducting all variable costs, shows a major improvement for Tesla over the years, being at basically 0% and even slightly negative as of 2019 and clearly worse than their competitors, to be twice as good as the auto industry and just above the overall economic index, presenting a peak operating margin of 16%. The decrease in the last two quarters can be explained by the increase in costs, mainly for research and development.

4.2. Ford

Ford Motor Company is an America automaker, founded in 1903 in Detroit, Michigan by Henry Ford. As of 2023, Ford has revenues of $174.2 billion compared to Tesla's $96.7 billion (Yahoo Finance). However, as far as profit goes, Tesla registered $12.6 billion versus Ford's $2 billion, showing a much better profit margin. This is happening while Tesla has not yet fully entered two of the main sectors of the automotive business, the truck (only in November 2023) and low-cost vehicles. Regarding electric vehicles, in 2023 the Detroit based automaker sold over 61,000 units in the US, compared to Tesla's 1.8 million, showing the huge gap in reach between the two. Nevertheless, Ford has already shown some signs in making the

transition into electric vehicle production, with the introduction of the all-electrical F-150 truck that was intended to produce 150,000 units in 2023 but only delivered 24,000. Nevertheless, these daunting numbers and adding to the fact that Ford loses around $47,000 per EV sold, have pushed the legacy automaker to scale back their EV sector for 2024. As for market capitalization, Tesla's is at $790 billion and Ford's is at $49 billion, showing that the investor sentiment is much more behind Tesla's vision. Despite these factors, Ford still outsells Tesla, delivering almost 2 million vehicles during 2023 versus 1.8 million from the Texas based company. Based purely on this preliminary numerical analysis, it is clear that some interesting phenomenon is occurring in Tesla's valuation.

4.3. BYD

The second direct competitor we will discuss, is the Chinese car manufacturer BYD. BYD Co. Ltd. is a Chinese manufacturing company and was founded in February 1995. It is the world's second largest electric vehicle manufacturer only behind Tesla (outsold Tesla in Q4), as well as China's biggest automaker and as of 2023, they will focus solely on electric vehicles.

Figure 13. Comparing BYD and Tesla sales per quarter. Companies' data

In the graphical description (figure 13) of unit sales above, it is clear of the meteoric rise of BYD, even compared to a very fast-growing company such as Tesla. The only caveat is that a significant number of sales from BYD are from plug-in hybrid electric vehicles, making Tesla the largest all-electric manufacturer in the world, which represents 100% of their car sales. Plug-in Hybrid Electric Vehicle (PHEV) are like EVs except that they also come with a back-up petrol-powered internal-combustion engine for instances when the battery runs out of power. When the comparison is made between both companies in fully electrical vehicle (Figure 14), it shows that Tesla and BYD have been growing at a similar after the middle of 2022, with the American automaker maintaining its clear lead in the market.

Additionally, just like Tesla, BYD also has energy production and storage businesses, mainly solar and battery pack production.

Figure 14. Comparing Electric Vehicles sales from Tesla and BYD. Companies data

As for market capitalization, BYD is worth around $84 billion which, as we saw earlier, is still very far away from Tesla's market valuation. In terms of revenue, the two companies are much closer together, with BYD reporting a 2023 revenue of $81 billion and Tesla $97 billion. For stock performance, Tesla had a very bad 2022 coming from $352.26 on 31/12/2021 to $123.18 a year later, but bouncing back and hitting a max of $299.29 and finishing the year at around $250. As for BYD, the path was similar, but less drastic losing 27.7% in 2022 but recovering 25.7% through September before dropping to the values of early 2023.

4.4. Self-driving Vehicles

Lastly, we would like to discuss what is the industry's landscape around self-driving cars, besides Tesla's FSD. Just using the previously analyzed competitor, BYD does not truly believe in self-driving cars but is mainly focused on production and manufacturing automation. Several major companies in the auto industry have allocated resources to try and solve a self-driving car, such as Hyundai, Volkswagen and General Motors (GM). Unfortunately, for healthy competition's sake, their programs are in an embryonic stage when compared to Tesla's FSD, in both processing capability and data acquired for machine learning use. Companies such as GM, outsource this type of product development, making them lose a bit of overall control over the program. One organization that is worth mentioning that is a real player in this undertaking is Comma.ai. They are not directly connected to any car manufacturer but are instead a software company. They intend to allow their program to be downloaded to over 250 different types of vehicles, showing a much greater flexibility. According to their founder and former CEO, George Hotz, they are currently 1 to 2 years behind Tesla, which even if it is to be believed, it is still a world of difference in the software world. Other software companies with some hardware integration are the likes of Waymo, Cruises and Baidu but they are significantly farther away and make use of different technologies. Waymo, for example, uses LIDAR (Light Detection and Ranging) as their navigation system, capable of providing a 3D view of their surroundings. How far away they are from Tesla can be graphically observed (Figure 15), that shows that the so important training data, or miles driven autonomously, is very scarce in these competitors when compared to Tesla. This not only indicates the current state of each program, but also its ability to improve over time.

Figure 15. Autonomous Miles Run Rate between several companies developing FSD software. Ark Invest

CHAPTER 5

SWOT Analysis

Strengths:

- Established market position: Tesla is now one the most recognizable car manufacturers in the world, and for the past 12 months particularly, they have cemented themselves as one of the best-selling car companies around the globe, including having the world's best selling car in the Model Y.
- Large scale capital: With a market capitalization value just shy of $800 billion, the ability for Tesla to raise capital for its investments is a definitive advantage over its competitors.
- Loyal and established costumer base: Tesla customers are some of the most loyal in the industry with approximately 67% of Tesla owners return to purchase another vehicle, far surpassing the industry's average luxury brand loyalty rate of 46%.
- Vision and message for the future: The ambition to accelerate the transition to renewable energy sources and its advanced AI program, customers feel like they are buying more than a car, but a precursor to something with almost limitless potential. Led by CEO Elon Musk, the ability for Tesla to spread its goals and ambitions is second to none.
- Uniquely skillful, motivated and well-funded research and development (R&D) teams: Tesla is the second most desired company/organization in the US for engineering students coming out of university, only behind SpaceX, and so they have a unique ability to hire talent.
- Product quality and innovation: Over the years, Tesla quality has increased significantly mainly by introducing more automated steps in their production line. Additionally, the innovation is a staple of Tesla. Even though they are usually late on their major innovative projects' deadline, they deliver it, nonetheless.
- Vertical integration and supply chains: Vertical integration is the business strategy of acquiring and controlling several steps of the supply chain, and with that it is possible to cut costs, increase efficiency and control and have an overall better understanding and quality of the final product. The most important example of this is the production of batteries by Tesla itself.

Weaknesses:

- Supply and demand issues: Tesla has different problems in this department on both sides of their vehicle spectrum. The first one is that for both Models 3/Y, the demand is bigger than the supply,

causing Tesla to lose some of its business to its competitors or leave the loyal customers waiting for their vehicle longer than expected. On the other hand, Models S/X have a bigger supply than demand, meaning that the factory making them might not be working at full capacity.

- Highly expensive R&D ventures: Even though innovation is the core of Tesla's business, it does not come without a cost. Some of these projects are extremely expensive and usually have a long-term goal in mind, meaning that the returns will not be seen in years, or maybe even decades. Their expenditure on R&D for 2023 came close to $4 billion.
- High delivery times: One of the main complaints amongst Tesla buyers is the waiting time between ordering and delivery, with the average duration being 2 months but extreme cases are reported to be more than 9 months.
- Mechanical and software development complications: Throughout the years, Tesla had several mishaps along the way, to troubles in the production line of the Model 3, to setting unrealistic expectations for several deadlines, such as FSD and the Cybertruck.
- Lack of a true low-cost vehicle: As of September 2023, the cheapest Tesla vehicle is the Model 3, which starts at around $40,000. In the US, which as a GDP per capita of which is in excess of $80,000, this price is very competitive, but in much of the world it is not. To fully take over the market, Tesla needs to introduce a cheaper vehicle.
- Lack of marketing campaigns leads to a significant part of the prospective customer base to be unaware of their products: Tesla was and is a strong believer that if the product is good enough, then advertising is mainly useless. However, in May of 2023, the company had its first commercial ever and seems like there is a change of heart. An improved marketing campaign can really push Tesla to the next level by making an increasing number of people aware of the quality and practicability of an electric vehicle.

Opportunities:

- Untapped markets: Despite the increased adoption of Tesla and overall electric vehicles around the world, that are still so much potential for growth out there. Besides China, Europe and North America the market penetration for the company is near null and in 2023 over 47% of its revenue came from the US alone.
- Increase vertical integration even further: In-house manufacturing of additional components in the supply chain is critical to long term success. Tesla has started doing this, by laying the building block for a Lithium (key component for battery production) refinery in Texas. Additionally, the

manufacturing of in-house chips, more specifically the D1 chip, for the Dojo supercomputer is already being manufactured.

- Low-cost model and market share: This case is both a weakness and an opportunity. The already announced, but still not unveiled, next-generation vehicle that is most likely the cheapest ever produced by Tesla can truly lead to a major proliferation of Tesla's electric vehicles on the world's roads. Although the public perception that electric vehicles are prohibitively expensive is incorrect, Tesla's are not exactly cheap, particularly outside the US where the GDP per capita is lower. Taking this into consideration, a cheaper model is crucial for Tesla to gain market share across the globe.
- Pedal to the metal for FSD: The ability to truly proliferate FSD worldwide, since it is still in beta testing and only available in North America is key. It is the major asset for Tesla that truly makes it different from every other car manufacturer in the world and its success will guarantee that the company will flourish in the next decades. Besides the obvious technical challenges, other obstacles such as regulation also exist.

Threats:

- Threats of new market entrants: The threat that every single company that is already accommodated in a specific industry face, is the entrance of a new competitor, even worse if that entrance is a disruptor. That can lead to diminished market share, revenues and eventually profits.
- Limited charging infrastructure: As good and ground-breaking the supercharger network is, the overall number of charging ports still needs to increase by several orders of magnitude for it to be even comparable to infrastructure available to combustion engine vehicles.
- Raw materials supply and ethical behaviors: One of the main metals necessary for battery cell production is cobalt. This material is prevalent in Central Africa, and its mines are heavily tied to child labor. Tesla needs to distance themselves from these claims, and they have, with the hiring of external auditors, to confirm that nothing strange is happening in the company. Besides that, another required metal for batteries, lithium, is now six times more expensive than in 2021, making a severe increase in variable cost and a threat to the future of lithium-based batteries.
- Hybrids: As was already discussed, Tesla is all-in on the manufacturing of all-electric vehicles, and especially in the short run we also saw the success of BYD. This success is mainly based on hybrid vehicles. As the infrastructure and battery energy density improves, hybrids will most likely lose their space in the industry, but as of now, hybrids play a big role in the market of people looking to own a "greener" vehicle but cannot logistically own an all-electric vehicle.

- The competition: Tesla had a head start to some of its main competitors and soon part of that competitive advantage will disappear, because they have a very deep end of resources. In the face of that, Tesla must continue to innovate and push the limits of modern electric transportation and all the related goods and services.
- China vs US: Tesla has serious commercial interests in both the US and China. As both are the two major superpowers of the 21st century and with the tension around Taiwan rises, the possibility of a commercial conflict and even a military conflict, would severely harm Tesla's production and sales capabilities, disregarding the almost infinite additional negative consequences.

CHAPTER 6

Financial Analysis

Financial analysis is a process required to properly assess businesses, endeavors and budgets with the intent of providing information about an entity's solvency, liquidity or profitability. This is of extreme importance when making investment or business decisions. To do so, we will require an extensive look through the company's financial statements, such as the income statement, cash flow statement and balance sheet.

This particular analysis will be made with data from Tesla's financial statements over the past five years (2019-2023) and will be presented in four distinct sections: Profitability, Liquidity, Solvency and Growth. It is also important to add that an additional analysis section is also used in some cases, the Dividend Analysis. However, Tesla does not pay dividends and never has so the analysis would be mostly useless. This is mainly because they reinvest their profits back into the company, partially responsible for the major capital gains for their investors.

To get truly meaningful data of this analysis, we will compare Tesla's results with one of their biggest and most established competitors, Ford.

6.1. Profitability Analysis

Profitability is the profits that a company makes in relation to its expense, so profitability analysis is used to get a better understanding of the various revenue, margin and profit streams while using them to give the management and shareholders a better grasp of the firm.

To do this analysis, we will use a diversity of several profitability ratios, and these can be divided into two distinct categories: margin ratios and return ratios. Margin ratios are used to properly assess a firm´s profitability at various cost levels of inquiry and some of these ratios are gross margin, operating margin, and net profit margin. These ratios, despite their similarities, are used to better understand different areas of the business. Return ratios, on the other hand, provide data that can be utilized to understand how well a firm can generate returns and create wealth for its investors. Some of the most used return ratios are return on assets (ROA), return on equity (ROE) and return on invested capital (ROIC). All ratios will be multiplied 100 to get the result in a percentage format.

Table 1. Profitability Ratios. Own estimates based on Tesla's and Ford's Financial Statements

Gross Profit Margin can be calculated by subtracting the revenues by the cost of goods sold, dividing that by the revenue. So, it can be interpreted as the amount of profit made after taking into account the costs of doing business and shows how efficiently a company is manufacturing and selling its products. The values presented in this table for the Gross Profit Margin tell a very different story for both companies. Across the analyzed years of 2019-2023, Tesla always has a higher ratio than Ford, and in both 2020 and 2023 it was, for all intents and purposes, twice as good. This means that Tesla is far better at creating revenue per dollar spent to attain those revenues than the historical automaker.

The operating profit margin measures the percentage of profit a company generates from its core business activities for each dollar of sales after deducting the operating expenses, which include both variable and fixed costs of production. It reflects the company's ability to control costs and generate profit from its primary operations. It can be calculated by dividing Operating Income by revenue. Here, Tesla's evolution through the years really shows. In 2019, they had a negative operating profit margin, meaning that they were losing money for vehicle sold, justified by the high operating expenses when compared to 2020. After 2019, Tesla consistently outperformed Ford in this ratio showing a consistent ability of creating more profit per dollar of their sales.

Net profit margin is intended to measure how much profit is generated as a percentage of revenue, so we can calculate it by dividing the Net Profit by Total Revenue and is a key indicator of the company's overall profitability. Again, the same pattern emerges, Tesla was still in financial development in 2019 and so their Net Profit Margin is negative while Ford's is marginally positive. Besides 2021, Tesla outperforms Ford, meaning they are significantly more profitable than the legacy automaker. The outlier is the year 2021, whose values can be justified by an uncharacteristic increase in net income, propelled by the other unspecified income from Ford.

Return on Assets (ROA) intends to determine how profitable a company is in relation to its total assets, so to calculate this ratio we simply divide net income by the total assets. Again, Tesla dominates Ford in this ratio, mainly in the more recent years of 2022 and 2023. This shows a very positive trend for Tesla and proves that they can maintain and even improve their ROA even though their assets have gone from $52 billion in 2020 to $106 billion in 2023. In contrast, Ford seems to be almost stagnating as their ROA is

basically the same as in 2020 as well as their assets that were valued at $267 billion in 2020 and $273 billion in 2023.

Return on Equity (ROE) is a financial ratio whose purpose is to estimate how a company manages the capital that shareholders have invested in. The higher the value of the ROE, the better the firm's ability to generate income and growth from its equity financing. To calculate it, we divide net income by shareholder equity. Tesla is highly dependent on equity for their financing when compared to Ford as we will see soon, this means that they are less likely to shift as drastically in their ROE from year to year. This volatility at Ford can once again be seen in 2021, a significant increase in their net income is translated as a dramatic increase in their ROE. However, specifically in the recent past, Tesla has been able to generate income from their financing through equity.

The Return on Invested Capital (ROIC) is a calculation that aims to assess how well a company can allocate its capital to profitable endeavors and investments. It can also be looked at as the amount of money a firm is able to make that is above the average cost it pays of both its debt and equity. We can calculate it by dividing net operating profit after tax (NOPAT) by invested capital. Since most companies do not provide information about NOPAT, we require to calculate it by multiplying Operating Income by one minus the effective tax rate. If the ROIC is greater than its WACC, a company is creating value. Ford's WACC is around the 7% mark, according to industry analysis, showing that they usually come short of that number and that they are not creating enough value for their shareholders. Tesla's WACC is higher than Ford's, at around 12%, however their ROIC is also higher. Particularly since 2021, Tesla has repeatedly supplanted that 12% mark and provided their shareholders with more than enough value for their investment. Despite the smaller operational income for Tesla in 2023, the ROIC increased because in this year the effective tax rate was -50%. On the other hand, for the five analyzed years, Ford has always failed to meet its 7% target by quite some margin, showing that it costs them more to be able to invest that they can generate from that same investment.

6.2. Liquidity Analysis

Just as we did before with the profitability analysis, we will now utilize liquidity ratios to perform a liquidity analysis of Tesla. These ratios are used to measure a company´s ability to meet its debt payment requirements and obligations in the short-term without the need to raise additional capital, as well as the company´s safety margin. To do this, we will use ratios such as current ratio, quick ratio and cash ratio.

Table 2. Liquidity Ratios. Own estimates based on Tesla's and Ford's Financial Statements

The current ratio is used to tell market participants how a firm can maximize its current assets to meet its obligations, such as debt and other payables. We can calculate it by dividing current assets by current liabilities and a slightly higher than average current ratio is the ideal point to be. A very high value indicates inefficient asset management, and a very low value may be an indicator of a higher risk of default. As a trend of the last 5 years, Tesla has been consistently superior in their Current ratio with the outlier being the year of 2019. This can once again be justified by the fact that Tesla was still a very "green" corporation. The outlined over performance is an assurance to creditors and investors of the company's liquidity health when compared to an industry competitor.

The quick ratio is utilized to assess a company's ability to use its near-cash assets (which are a type of assets that can be quickly converted to cash) to pay its current liabilities. It is a more conservative measure than the current ratio since it uses only a specific part of the assets. To calculate the quick ratio, we divide the most liquid assets (cash, cash equivalents, marketable securities and accounts receivables) by total current liabilities. An additional way of calculating this ratio is by subtracting inventory from the current assets and dividing the result by current liabilities. The higher the value of this ratio, the higher the liquidity of the firm. This ratio is the one that Tesla and Ford are closer to each other. This is mainly due to Tesla's high value of its inventories that are not accounted for in the quick ratio. Both companies are around the 1 value of the ratio, meaning that they have the capability to use their assets that can be converted to cash to settle their current liabilities.

The cash ratio can be calculated by simply dividing cash and cash equivalents by the total current liabilities. This ratio is even more conservative than the quick ratio since it only uses cash and cash equivalents. It is mainly used to assess a company's ability to meet short-term obligations using only cash. A ratio greater than 1 means a firm has more cash and cash equivalents on hand than current debts, while a calculation less than 1 means a company has more short-term debt than cash. This ratio has very different results than the quick ratio, particularly for Ford. Their values are very far from both Tesla's and the benchmark of 1, showcasing a very unhealthy amount of short-term debt when compared to their cash reserves. This decrease can be justified by the fact that marketable securities have a very important role at Ford and are not included in the cash ratio. For Tesla, they are always around the mark of 1 for their cash ratio. This shows a more secure state for Tesla and a theoretical total ability to meet their short-term obligations, increasing confidence from both creditors and investors.

6.3. Solvency Analysis

In contrary to the previously discussed Liquidity Analysis, Solvency Analysis measure a company´s ability to meets its long-term financial obligations and debt. To do this analysis, we use solvency ratios such as debt-to-assets ratio, the interest coverage ratio, the equity-to-assets ratio, and the debt-to-equity (D/E) ratio. They are usually used by entities or individuals that are possible lenders to the firm, to estimate its creditworthiness.

Table 3. Solvency Ratios. Own estimates based on Tesla's and Ford's Financial Statements

The debt-to-assets ratio is calculated by dividing a company's outstanding debt by their total assets and it intends to demonstrate the scale at which a firm has used debt to finance its assets. The larger the value of this ratio, the more of their assets are being financed by creditors. Here, the difference in financial philosophy is as visible as it will ever be. On one side, Tesla tends to use very little debt to finance their assets, with the exception being 2019 and we already have made mention that this is not a year that is aligned with Tesla's recent past and future expectations. On the other hand, Ford makes use of debt to fund most of their assets, since their debt-to-assets ratio sits always above the 50% mark. This leaves Ford with a yearly interest expense well north of $1 billion.

Secondly, we will analyze the results of the interest coverage ratio. This ratio intends to measure a company´s ability to pay interest on its outstanding debt and can be calculated by dividing Operating Income by its interest expense during the determined time period. Usually, a higher coverage ratio is better, however the analysis is not so "black or white" and can vary according to the industry. For this ratio, a familiar pattern repeats itself. 2019 is the outlier, once more emphasizing how "green" Tesla was at that stage, but also with a clear path to success. The following 4 years, a different story occurs and the ratio values for 2022 and 2023 are a perfect picture of how different are both financial approaches. Ford relies much more heavily on debt, so it is predictable that their interest expenses will be much higher. Tesla, on the other hand, leans more towards equity financing and therefore has a much lower interest expense and consequently a higher interest coverage ratio.

The equity-to-assets ratio is computed by dividing a firm's total equity by its total assets. It expresses the portion of the company´s assets that are financed by equity. In this case, a higher number is better since it signifies higher stability and creditworthiness as well as a lower financial risk and leverage concerns. Once again, Tesla outperformed Ford heavily across the years, even in 2019. This was a very predictable

result for this ratio after we determined that Ford relies heavily on debt to finance their assets, meaning that they do not emphasize their financial needs through equity.

Lastly, we will analyze in the solvency analysis is the debt-to-equity ratio, meaning that for us to calculate it we will need to divide the firm's debt by its shareholder equity. It is used to evaluate a company's financial leverage, meaning that it intends to understand how much a company is financing its operations with debts instead of using its internal resources. Comparing similar companies, one with a higher debt-to-equity ratio is correlated with additional risk. Here things get a bit negative for Ford. In the 5 years that are being analyzed, the Detroit based automaker averages a debt-to-equity ratio of 392% which is a very high number, and signals difficulties in serving debt obligations and leaving them very vulnerable to industry downturns. On the opposite side, Tesla has shown a very competent debt-to-equity ratio over the years (with the now common exception of 2019), messaging their creditors that they are in a robust situation and very well capable of handling even something that is partly unpredictable, such as the global economic activity.

CHAPTER 7

Valuation

In this section, we will use several different models to do a valuation of Tesla. The ones we will use are the DCF method with both the FCFF and FCFE approaches, the EVA method and ultimately the Relative Valuation Model. By using different models with varying pros and cons for a company like Tesla, will allow us to get an accurate view of the company´s valuation that encompasses these models.

7.1. Assumptions

To be able to properly run the models, we will require some future predictions (4 years) and to get those, we will use past data (5 years) to do a forecast for the future. Not every metric will make use of the past five years, since some outlier values might skew the values in a damaging manner.

Table 4. Income Statement. Own estimates based on Tesla's Financial Statements

This information was taken from Tesla's financial statements (both company website and 10-K Form available in the SEC) as well as Yahoo finance. The projections were made based on the past years, and Revenue was calculated by a 31.54% increase YoY.

Table 5. Ratios needed to infer future Cost of Revenue, Operating Expenses and Depreciations and Amortizations. Own estimates based on Tesla's Financial Statements

Afterwards by calculating the 5-year average for the first 2 ratios in the table, we can then get the future Cost of Revenue and Operating Expenses, therefore reaching the Operating Income. The Depreciation and Amortization (D&A)/Revenue will be used at a later stage.

With a cost of debt of 9.1% calculated when computing WACC, we can get the future interest expense, starting from the fact that debt is decreasing 6.53% YoY. From this we get Earnings Before Tax (EBT) and we now require the Income Tax Rate. For that, we did not take all five years into account, but instead we removed the biggest (25.3%) and smallest (-50.15%) values. Afterwards the average of the three central values gets us the Income Tax Rate of 12.38%. We can then get the value of Income Tax and then by subtracting it from EBT, we finally reach Net Income.

Working Capital

$$WC = \text{Total Current Assets} - \text{Total current liabilities} \quad (7.1)$$

Table 6. Working Capital Calculation. Own estimates based on Tesla's Financial Statements

Table 7. Calculation of future Changes in Working Capital. Own estimates based on Tesla's Financial Statements

To be able to forecast working capital for the future, we made use of a working capital/revenue ratio, and we once again dismissed the highest and lowest values, so the average from 2021 to 2023 was used, which value is 17.58%. We then can get both the working capital as well as its change YoY.

Capex

Table 8. Capital Expenditure Investment Calculation. Own estimates based on Tesla's Financial Statements

In this case, we made use of a similar ratio than before but using Property, Plant and Equipment (PP&E)/Revenue, and we utilized an average of the years 2022 and 2023. We felt like these were the years that better reflected the future of the company. By doing this, we can now predict the future absolute value of PP&E for every year. Afterwards, by subtracting the PP&E of year N by that of N-1 to achieve Net Capex. Finally, we arrive at the value of Depreciation and Amortization (D&A), and that description was shown on table 8, showing a 6.13% ratio of D&A/Revenue, calculated as a 5-year average. By adding D&A with Net Capex, we get Capex Investment per year.

7.2. Discounted Cash-Flow Model

Weighted Average Cost of Capital

At the base of the FCFF approach to the DCF model, is the discount rate that we will use to be able to calculate the continuity value. This discount rate is the Weighted Average Cost of Capital (WACC) and can be computed as:

$$\text{WACC} = \frac{r_E \times \text{E}}{E+D} + \frac{r_D \times \text{D}}{\text{E} + \text{D}} \times (1 - t_c) \quad (7.11)$$

- r_E – Cost of equity – required rate of return by equity holders;
- E – Market value of the firm's equity;
- (E+D) – Total market value of the firm's financing;
- r_D – Cost of debt – required rate of return by debt holders;
- D – Market value of the firm's debt.

Weights

To be able to calculate the market capitalization, we need to multiply the number of outstanding shares (3.176 billion) by the value of each share as of December 29, 2023 ($248.48). The debt value is much easier to achieve, we just had to look in Tesla's 10-K statement and add both short and long-term debt. We also computed the percentage of both debt and market capitalization for the share of each of the entire company.

Table 9. Debt and Equity weights. Own estimates based on Tesla's Financial Statements

Cost of Equity

We can calculate the cost of Equity by making use of the following formula:

$$r_E = r_f + \beta_E(r_M - r_f) \quad (7.12)$$

The risk-free rate was obtained by looking at 10-year US government bond rate and was set at 3.86%. The Beta can be computed by dividing the covariance of the returns of the market and the stock by the variance of the returns of the market. We used values from January 1st 2014 to December 29th 2023 and the S&P500 served as our "market". By doing this, we obtained a value for Beta of 1.48. As for the market risk premium, which we found to be 5.7% according to sources such as Statista. After running the formula, we concluded a 12.3% cost of equity.

Table 10. Cost of Equity. Own estimates based on Tesla's Financial Statements

Cost of Debt

To reach the cost of debt, we will add the risk-free rate with the default spread. This default spread is dependent on the company's credit rating. In the case of Tesla, this rating is of B- which equates to a 5.24% default spread, according to Moody's. We then arrive at a 9.1% cost of debt.

Table 11. Cost of Debt. Own estimates based on Tesla's Financial Statements

Weighted Average Cost of Capital

After all the processes described above, we now have all but one of the necessary parameters to be able to calculate WACC. This final piece of the puzzle is, of course, the corporate tax rate. This can be achieved with a quick Google search, since this tax rate is defined by law and in the case of the USA it is 25%. With that said, we can now make use of the formula at the beginning of this discussion, leaving us with a WACC of 12.23%. Since most of Tesla's valuation derives from equity, it is expected that its WACC and Cost of Equity are very similar.

Table 12. Weighted Average Cost of Capital

Free Cash-Flow to the Firm

We are now able to get our first real data point, our first stock target price. The last required data point is the terminal growth rate, which we set at 10%. This was set because of the high revenue growth observed in the past 5 years and showing no sign of slowing down and the expected long-term inflation of 3%. Additionally, considering also several analysts and Yahoo finance, we thought that value is representative of what we can expect in the future, and if something, is a conservative estimate.

Table 13. Discounted Cash Flow Valuation using FCFF. Own estimates based on Tesla's Financial Statements

We made use of Operating Income instead of EBIT as we did in the Financial Analysis, mainly for the lack of information regarding EBIT but also because Operating Income is better for both comparison and focus

on the core of the company's business activities. With that in mind, we first calculate FCFF by making use of the following formula:

$$FCFF = \text{Operating Income}\,(1 - t) + Dep\ \&\ Amort - CAPEX\ investment - WC\ investment \quad (7.13)$$

Following that, we discount the cash-flows using WACC for the 3 following years. We then require finding the Continuity Value Discounted and by adding it to the 3 previous years, we get the Enterprise Value. To reach the Continuity Value Discounted we require the following expression:

$$\frac{TV_n}{(1 + \text{WACC})^n}$$

Furthermore, we reach Equity Value by adding Non-Operating Assets and Cash and Cash Equivalents as well as subtracting Gross Debt. By then dividing the Equity Value by the number of shares outstanding, we finally get our Price Target in USD. This value of $86.54 is very far apart from the one observed in the market of $248.48, indicating that something out of the ordinary is happening.

Free Cash-Flow to Equity

The first step of this approach of the DCF model is to pass the FCFF to FCFE. To do that, we need to add yearly debt variation and subtract Interest Expense from FCFF. The debt variation and interest expense were already mentioned previously but not fully explained. We take a yearly debt change, in this case a decrease of 6.53% every year and since we know that the cost of debt is 9.1%, we can calculate the interest expense for future years.

Table 14. Debt predictions based on past data. Own estimates based on Tesla's Financial Statements

We now do the same procedure as we did for the FCFF approach but use Cost of Equity instead of WACC, to get the Continuity Value Discounted. The only difference to achieve Equity Value is that now we do not take debt into account and afterwards we only need to divide by the number of outstanding shares to arrive at the Price target. We can, once again, clearly see a major discrepancy between the value of the model and the price in the stock market.

Table 15. Discounted Cash Flow Valuation using FCFE. Own estimates based on Tesla's Financial Statements

Sensitivity Analysis

For this analysis, we intend to measure the impact on both approaches of the DCF model (FCFF and FCFE) when we change certain parameters of the model. For the case of the FCFF, we will change both the terminal growth rate (*g*) and the WACC. For the FCFE, we will change *g* and the Cost of Equity.

Table 16. Sensitivity Analysis for the FCFF approach. Own estimates based on Tesla's Financial Statements

Analyzing the FCFF table first, we can observe that the stock price increases as the terminal growth rate increases and as the WACC decreases. It is important that the WACC is larger than the terminal growth rate, otherwise it would lead to a mathematical indetermination (WACC=*g*) or a negative Continuity Value (*g*>WACC). For example, just a small change to the terminal growth rate from 10% to 11% would almost double the stock price, showing how sensitive these models are to the parameters. In the extreme scenario of an 11% terminal growth rate and a WACC of 11.5%, the stock price would be $375.42, vastly surpassing the current price in the stock market.

Table 17. Sensitivity Analysis for the FCFE approach. Own estimates based on Tesla's Financial Statements

For the FCFE approach the reasoning behind this analysis is the same, but in this case, we will analyze a change in the Cost of Equity instead of WACC. The values are very similar, only slightly smaller and that is due to the also smaller initial value. The relationship between *Re* and the stock price is the same as in the FCFF approach with WACC, as the difference between *Re* and *g* gets smaller, the stock price increases, in this scenario to a potential peak of $366.12, well above the $248.48 observed in the market.

7.3. Economic Value Added

We will now move on to a different valuation model, the Economic Value Added (EVA). The main goal of the EVA model is to measure the true economic profit generated by a company's operations after accounting for the cost of capital. By calculating EVA, we intend to assess whether they are creating value for shareholders by earning returns above the cost of capital employed in their business activities. We believe that this is a more suitable model for a corporation like Tesla, since they are very good at earning returns above their cost of capital and even their employee compensation plan (mainly stock options) focusses heavily on value creation.

The first step for the calculation of the stock value, is to calculate EVA and that can be done using the formula shown below:

$$EVA = NOPAT - (Invested\ Capital \times WACC) \quad (7.14)$$

Table 18. Future Operating Income and NOPAT values. Own estimates based on Tesla's Financial Statements

Table 19. Effective Tax Rate Evolution. Own estimates based on Tesla's Financial Statements

So, the first step of this process is to calculate Net Operating Profit After Taxes (NOPAT). To do this, we utilize the following formula:

$$NOPAT = Operating\ Income / (1 - Effective\ Tax\ Rate) \quad (7.15)$$

We calculated the forecasted Effective Tax Rate by a simple average of the past five years of analyzed data, reaching a value of -4.6%. These negative values are derived from tax incentives from Tesla's endeavors on electric vehicles and renewable energy as well as tax deductions surging from losses such as depreciation and amortization.

Table 20. Evolution of the YOY change of Invested Capital. Own estimates based on Tesla's Financial Statements

Afterwards, we require to get our yearly invested capital. We calculated that by making an average YOY change of Invested Capital of the four previous years, and that was a value of 19.96% increase per year. Obviously, we already calculated the WACC for the DCF model, and so we have everything we need for the EVA computation.

Table 21. Valuation using the EVA method. Own estimates based on Tesla's Financial Statements

Now that we have our EVA values, we can now discount them using the WACC and calculate our Continuity Value Discounted using the same Terminal Growth Rate of 10% that we used in our DCF model.

By adding our future EVA discounted and Continuity Value, we get MVA. We then add Invested Capital to achieve the Enterprise Value and to finally arrive at the Equity Value we need to sum Non-Operating Assets and subtract Gross Debt. The last step is dividing our Equity Value by the number of outstanding shares to reach a Price Target of $125.1679. This was a much closer value to the price observed in the stock market, confirming that this model is indeed better suited to a company with Tesla´s characteristics. This is because the EVA model mainly measures value creation for shareholders and Tesla has done that in spades. Nevertheless, it is still very far away from $248.48, deepening the clear dissociation between what the models predict and what the financial market does.

7.4. Relative Valuation (Multiples)

The goal of the Multiples Valuation model is to utilize financial data of companies inside the same industry to determine the value of the company being studied. The comparative corporations that we chose were Ford, General Motors (GM), Lucid and BYD. The goal of this choice was to get a high range of the spectrum of approaches in the industry by selecting two more established automakers (Ford and GM), mainly focused on combustion engine vehicles and two new-gen automakers (Lucid and BYD) with their vision more centered on electric and hybrid vehicles. The three ratios that we selected to analyze were the Price/Revenue, EV/Revenue and EV/EBITDA.

Table 22. Data and Multiples Ratios for several automotive companies. Own estimates based on the companies' Financial Statements

After acquiring all the relevant data from the sample companies, we could now employ our ratios to begin the process of multiple valuation. It is important to note that unlike the previous tables, these values are in thousands of USD.

Table 23. Median and Average Ratios of the ratios for the companies analyzed.

We also found that due to outliers in the data, using the average was not always the best course of action, therefore, for the EV/EBITDA we made use of the median to calculate the Implied Stock Price and the average for the remaining ones.

Table 24 and 25. Stock value for Tesla using 3 different ratios

The two tables reflect the two different methodologies for calculating the Implied Stock Price from our three ratios. In the Price/Revenue, the Price already represents the Market Capitalization of the company, therefore there is no necessity of starting with the Enterprise Value (EV) and subtract Debt and add Cash to get the Market Cap. The EV/Revenue and Price/Revenue have relatively similar values for the Implied Stock Price, $103.63 and $112.35 respectively, which are in line with the previous analyzed models. This gives a good base of discussion and can be seen as the benchmark for the value of Tesla stock. However, the EV/EBITDA is an outlier in our analysis and that is because the industry values for this ratio are very different than Tesla's. The median value for EV/EBITDA is 10.457 while Tesla's is 51.887, showing how much different they are from the competition in this regard.

Now we have decided to include a company, even though more on the hardware side, that is heavily involved in the AI space. This company is Nvidia, which is the main supplier of compute in the form of Graphics Processing Units (GPUs) for the main AI developers in the world like OpenAI and Tesla. This is to give a better understanding of how companies in this industry are valued by the market when compared to car companies.

Table 26. Introduction of Nvidia on Table 22. Own estimates based on the companies' Financial Statements

The first impressions are very clear, some of the ratios that seemed completely out of place in Tesla when compared to the auto industry, now seem mild compared to Nvidia's.

Table 27. Median and Average Ratios of the ratios for the companies analyzed.

Table 28 and 29. Stock value for Tesla using 3 different ratios

When comparing with our analysis without the presence of Nvidia, the difference is significant. All three ratios, now predict a stock price very close to the observed in the market as of December 29, of $248.48. It also to note that for this case, we utilized the average in all ratios, otherwise the inclusion of Nvidia would have very little impact on our analysis.

This shows that companies on the forefront of technological innovation are valued by the market in a different way than a company that has little to no true trailblazing spirit, since for companies like Tesla and Nvidia the financial statements are only capable of telling a small part of the whole story and investors know it.

Finally, we want to understand what the price of Tesla stock would be if it had the same metrics as a company like Nvidia. So, that is exactly what we did.

Table 30 and 31. Stock value for Tesla using 3 different ratios but with just Nvidia data.

The results are nothing short of surprising, showing that, according to this valuation methodology and using the same ratios as Nvidia, Tesla is highly undervalued.

CHAPTER 8

The Uniqueness of Tesla

8.1. Stock

It is now important to note how distinct and unique, not only Tesla as a company, but also Tesla's stock behavior is when compared to the market. From its mission to its products and services, to its marketing and communication strategy and all the way to its leadership, Tesla is a disruptor in the market. For those reasons, we cannot make a valuation of Tesla the same way we do it for any other corporation, since that would leave with incomplete or worse, incorrect conclusions. It is also clear now that a significant rift exists between the prices in the market and the valuation that our models gave us. So, in that light, an attempt to justify those differences is in order. Firstly, it is important to visualize how unusual Tesla´s stock evolution and performance is and to do that we will compare it with the S&P 500 index performance over time.

Figure 17. Investment profitability comparison between Tesla and the S&P 500. PortfoliosLab

This graphic (Figure 17) represents the percentage of profit for an investment made in early 2014. We can easily see that until 2020, the S&P 500 continuously outperformed Tesla but then everything changed. For the past 4 years, the index and the stock have represented polar opposites of investment strategies, while Tesla is a risky and volatile investment with massive upside, the S&P 500 is based on stability and long-term returns. During those 12 months of 2020, Tesla's valuation surged from $117 billion to $658 billion and by October 2021 it had reached a market cap of $1 trillion. This gargantuan increase can even be seen in the S&P 500 itself. Tesla entered the index in December 2020 with a weight of 1.6% and that had risen to 2.5% by the end of 2021, while being responsible for almost 26 percentage points of the total 96 of the index since the beginning of 2020, while the second most impactful company is this surge was Amazon at a much lower 17 percentage points. So, in this graphic we can not only see Tesla's massive increase in stock price, but we can also observe the consequences of it in the S&P 500, illustrating just how deep it was.

So, we now need to better understand the question, "What caused this meteoric rise in price?", and to do that we require a multilayered response. It is important to first understand that the electric car industry had been plagued with short sellers, still this day but at a higher rate until the pandemic. These investors base their decisions on the fact that they believe that electric cars will never be competitive

against combustion engine cars, due to the price, range and infrastructure required. However, in recent years due to technological developments and government incentives (particularly US federal and state) have shifted even some of the more pessimistic investors' stance on electric transportation. Additionally, the widespread use of financial products such as options and in green/tech related funds exerted a big effect on Tesla´s stock price. All of this gave Exchange Trade Funds (ETFs) massive profits in Tesla related products, which attracted even more investors in a "snowball" effect. This can be observed in the fact that in 2018 Tesla was a holding on 106 ETFs and by 2021 that number was on 244. The last major force was the retail investors, which we will discuss later.

In the following year of 2022, Tesla lost almost 70% of its market cap, starting the year trading stock at $399.93 and finishing it at $123.18. This can be partly explained by the increase in interest rates by central banks around the world, meaning that many investors looked away from risky investments and preferred to allocate their capital in less risky endeavors. This was felt across several technological companies with Meta's 65.5% drop, Amazon's 50.9% and Netflix's 50.8% declines. To compound on that, Tesla holding of Bitcoin was a fact well known and the cryptocurrency lost almost 2/3 of its value in 2022, exacerbating the already negative market outlook on Tesla. However, Tesla had an additional factor, their CEO made a very controversial acquisition, Twitter, for $44 billion. This process started in April and finished in October and had two distinct and compounding ramifications in Tesla stock price. First, Elon Musk had to sell shares to guarantee liquidity, and across the whole of 2022 he ended up selling up to $23 billion worth of shares, flooding the market and thus lowering the price. Additionally, investors, mainly retail investors, worried that an already stretched thin Elon Musk would completely neglect Tesla with an added responsibility, and so they sold heavily. Graphically, this can be easily observed in the almost vertical drop at the end of 2022. This unique relationship between CEO and investors is something that we will dissect further ahead.

After all the information provided, it is our expectation that we were able to convey the message that Tesla does not operate as an average company and because of that neither does its stock. We are now going to explain the observed differences between value and price following two main lines of thought: First, that Tesla is not a car company (or at least much of its value does not originate directly from the sale of transportation vehicles) and second, to better understand behavioral finance/investor sentiment and the impact of noise traders on the stock price.

8.2. Tesla's Valuation Drivers

In the products and services sub section of this paper, we already gave a solid rundown of Tesla's different areas of business and activity. It was clear that Tesla was indeed involved in many more undertakings than just the manufacturing and sale of transport vehicles. However, in 2023 over 85% of their total revenue was of automotive origin, so to say that Tesla is not a car company would be misleading. Nevertheless, it is also fair to say that a major portion of their valuation is not related to their achieved financial results, as we seen in the previous chapter.

So, in the technical side, there are several factors that push Tesla's stock to unprecedented heights in the automotive industry. The first disruptor would be the public's almost uniform opinion that electric vehicles are the future of transportation and that Tesla is leading that transition. This is obviously correct, as we have already explained, since the Tesla Model Y was the world's best-selling vehicle in 2023. Additionally, by confronting one of the biggest downsides of owning an electric car head on (the ability to quickly charge it) with the supercharger, Tesla was able to provide the world's first network of gas-station like charging stations and implement them in masse, even forcing main competitors to adopt their standard charging port.

The previously mentioned positive points for Tesla make them a unique car company, but a car company nonetheless. The true value creation in Tesla relies on their data collection and treatment and well as their highly advanced software. As we have discussed, their FSD program has the potential to be an absolute game changer, from the revenue of buyers and monthly subscribers to licensing to other car manufacturers and the possible creation of new businesses such as robotaxi fleets. The data and subsequent trained models created to create a self-driven vehicle can lead to some extraordinary achievements in other fields. We are talking about Optimus, the Tesla-made robot that has been developing at a lightning-fast pace. It could be used for personal and business activities and in a rental or purchase business model, unlocking a possibly very large source of revenue.

When we combine this with the energy production and storage side of Tesla, we realize that not only are different but related areas of business, but most importantly we see a lot of their investment is still to be explored financially. This means that the R&D expenses have been increasing relatively as much as their revenue, reaching a value of close to $4 billion in 2023 but with a small return in some areas. Some of these areas are extremely complex and complicated, so delays and obstacles along the way are to be expected and investors are mainly confident that these hurdles will be overcome. As we previously stated, Tesla's market valuation is unique in the car business, however it becomes less strange the more we realize

that it is one valued as a car company. When we compare it with corporations like Nvidia and that at the date that we are analyzing, December 29th 2023, was worth $1.23 trillion.

Overall, even though the financial statements and valuation models don't show it, Tesla's valuation can be partially explained by their unique approach to risk, innovation and technical challenges. By combining first principles thinking and impressive ingenuity, they have been able to captivate millions of customers and investors to get behind their vision of the future. This vision is one of clean energy production and transportation, self-driving vehicles and mass-produced robots made for human assistance. Even though the full impact of these investments is not quantifiable, and so some investors will not value them, it is not difficult to see the full potential of their goals.

8.3. Behavioral Finance

Despite all the progress, when innovating as much as Tesla does, success is most definitely not guaranteed. With this comes failure, rising costs and increased doubt amongst the more neutral investors. So, why does the stock fluctuate as much as it does and why is it that so many people are attached to Tesla? To answer this question and to finalize our justification for the disparity of price and value, we will make use of Investor Sentiment, Behavioral Finance and Noise Traders.

The first of these topics that we would like to address is the Noise Traders. As we have explained previously, these are investors that make their capital allocation decisions based on incomplete and sometimes wrong information, usually following the narrative that makes more "noise". This sort of communicators is very present around Tesla. One such investor is Cathie Wood, founder and CEO of ARK Invest, an Investment Fund. Cathie has been an advocate for active investment and that this capital allocation strategy is key for societal development. Nevertheless, she has been almost unrealistically bullish for Tesla stock, claiming in 2019 a $4,000 price target for the following five years. Such vocal investors around a stock price, create an unrealistic narrative about a company's share price and inflating it. This effect is usual one that can be felt in the short/medium term, since once those noise traders stop making that "noise", the momentum of the stock dies down.

The noise trader hypothesis is not an argument against real valuation but a partial explanation for why, even in the context of fundamental valuation and assuming market efficiency, stock prices at Tesla embark on runs that seem to be irrational, as we saw earlier. The reason is overlooking the fact that narratives are part of information set that affects stock prices and enters fundamental valuation. In this context, "irrationality" basically means rejecting one narrative in favor of another. As many Tesla short sellers can

surely identify with, people who bet against the company's narrative, with a long-term investment goal, have lost immense amounts of money thus far. That said, it is a mistake to accept any price for Tesla as reasonable just because there is some narrative that produces that. This narrative that we discuss here is the questions that we already posed, such is Tesla a car company and if not how much of its valuation does directly come from the additional business areas. So the investor is required to answer these questions but also to understand the market feeling, in order to predict the stock price in the near or far future. The narrative hypothesis also suffers from the "snowball" effect, since a positive outward message drives up the stock price, corroborating the original narrative and thus attracting even more investment, with the possibility of no real added value.

To better understand and quantify this phenomenon, we intend to implement volume analysis. This measures the amount of shares that are traded each day, giving us a good insight into general interest changes in Tesla stock. A price move accompanied by a large volume is more likely to indicate a trend than the same price movement with a lower trading volume, on the other hand, a big spike in trading volume can also indicate a trend reversal. We will analyze 3 major stock movements: the spikes in price of late 2020 and 2021 as well as the drop of late 2022.

Figure 18. Comparison between stock price and trading volume. Own analysis based on public data.

In several cases we can observe that traded volume is a precursor for future stock movements. The big price increase through 2020 was preceded by a major spike in volume in late 2019/early 2020, giving a clear signal of a shifting sentiment in investors regarding Tesla. We continue to see a similar trend across the whole graph, a major decrease in volume in mid-2020, leads to minor decrease in share price in mid/late 2020. Perhaps the contrarian to this hypothesis would be the price jump in late 2021, which is followed by months of continued volume decrease and a volume increase in the same month as the price spikes up. Later in 2022, the major decrease in price is was preceded by a small decrease in volume, however as volume rose significantly, so did the price. Even though sometimes the change is greater in one of the metrics analyzed, the lagging correlation is clear, and it signals the importance of the sentiment around a stock and the impacts that it can have on that stock's price. This proves that the "herd" phenomenon is present at Tesla stock trading, meaning that price trends are amplified by investors only following those trends, leading to these peaks and valleys in the stock price. This also creates a "snowball" effect, since, for example, in a bull market if investors buy and the "herd" just follows buying in massive

amounts, the price will spike up, proving the initial analysis correct leading to overconfidence and increasing buying.

Finally, and to give a deeper understanding of the Tesla stock phenomenon, behavioral finance and the unique relationship between the retail investors and the company/CEO. As we previously mentioned, Tesla has many of the characteristics of a company that can create in investors, particularly retail investors, the feeling of investing in an exciting future. Combining that with the credibility of their past achievements, that makes their ideas a possible reality that many would like to help make happen. This sentiment is usually even more exacerbated by the success of other innovation driven companies owned by Elon Musk, such as SpaceX and Neuralink that serve as proof of past and current accomplishments. This synergy between the CEO and retail investors is key to the success of Tesla in the stock market and one event is very worthy of exploring deeper, even though it is outside the time-frame of our stock analysis. In 2018, 73% of Tesla shareholders approved a potentially $56 billion pay package to Musk, in the form of stock option, that would see him earning nothing unless some market capitalization and operational criteria were met ($50 billion in 2018 to almost $800 billion by the end of 2023). Yet, to make sure that his fate would be linked with the company's, Musk could not sell the stock options for five years after the fact. Each milestone would come in $50 billion dollars increments, and Musk would only receive the $56 billion if within a decade, Tesla would reach a market capitalization of $650 billion as well as unprecedented revenues and earnings. These requirements were labeled at the time as nearly impossible, and yet they were met in full. Despite this and after a shareholder lawsuit, a Delaware judge, in 2024, decided that the shareholders were misled and mandated a new vote on the already decided matter. However, over 90% of retail investors voted in favor of the pay package, in essence saying that the continuation of the CEO is more beneficial to the company's future than $56 billion. This shows that many investors put a great deal of importance, perhaps too great, on one man and as such the price of Tesla stock is deeply connected to one man, making it very volatile and risky for the long run. In the end, over 73% of shares voted in favor of reinstating the pay package in full, the same percentage as the initial vote in 2018.

CHAPTER 9

Conclusion and Recommendations

This work intended to provide an extensive and in-depth analysis of Tesla, both its stock as well as the business, as one is always a result of the other. Only by having an extensive knowledge of both, could an informed investment decision and recommendation be made. It is also important to note that, as we mentioned before, the financial models can only tell a part of a very long story, and even though they are the basis of our analysis, they are not the end of it.

To value Tesla, we started by making use of 3 distinct valuation models: the Discounted Cash Flow model (FCFF and FCFE approaches), the Economic Value Added and Relative Valuation. These models gave us different numerical results, but a straightforward answer: Tesla is overvalued. The exception to this conclusion was when we introduced a technology based company in our Relative Valuation model, giving us a different insight into how the differently market perceives similar financial results according to the industry in which they occur. Compared to the real price of $248.48, we got $86 dollars with FCFF and $82 using FCFE as well as $125 with the EVA model. Finally, by making use of Relative Valuation with multiples, our values ranged as low as $54 when comparing with the auto industry but as high as $786 when compared with Nvidia. The result that we feel best encapsulates Tesla, by being both a technology and car company, is the result when all companies are considered, giving us a value between $224 and $194, depending on the used ratios. This is a close resemblance with the market price of $248.48.

Based on the values that we just saw, one would think that the recommendation would be to sell or even short Tesla, even though this strategy has historically backfired. However, as we have seen, this is just part of the story. Tesla revenue is growing at 31% a year, and the major financial ramifications of all their R&D and innovation are not seen yet, making their true growth potential still be very much hidden behind some of their partially released and even unreleased products and services.

Another important matter to discuss before deciding an investment plan is each investor's willingness to take risks. As we discussed, Tesla stock price is highly volatile so margin or leveraged investing is not advised and the short-term gain mentality can have negative consequences and make the investor lose a significant portion of their investments. Therefore, any investor that has a low risk tolerance or low liquidity should not invest in Tesla, since any scenario, good or bad, is a plausible outcome. Their main driver for their ridiculous market capitalization is FSD and Optimus and all the data that is associated with them,

which are not guaranteed successes and have no delivery dates. If Tesla fails at those, they will just be another car company, probably a very successful one, but in which case, an $800 billion valuation truly makes no sense.

For risk neutral investors, holding the stock or not buying it would be the advised course of action. Be aware of any major leap in the technology that we have extensively discussed and adapt from there. Additionally, as we have seen that can happen, if a not rational drop in price happens, that opportunity should be exploited by buying Tesla stock.

Ultimately, for risk-taking investors, Tesla is a buying opportunity. The upside of this company is almost second to none and there is no great reward with an equal amount of risk attached to it. If Tesla can solve self-driving cars, as their progress after changing to neural networks suggests, then the entire transportation ecosystem changes. If Tesla can create the world's first low-cost functional humanoid robot, the entire manufacturing industry and the human-robot relationship will undergo a massive shift. These are several "if" statements and with them comes uncertainty and risk, and with that comes the possibility of reward.

Ultimately, even if Tesla fails at all their new disruptive plans, they already were the major drivers for the proliferation of electric vehicles and their infrastructure. They managed to completely shift public perception on electric cars, from boring, slow and low range vehicles to fast, futuristic, practical and appealing. Additionally, their battery storage business is also something of extreme importance as the entire planet transitions to renewable energy. That was the initial goal of the company, and it has succeeded, and because of that millions are now "betting" that they can do it again.

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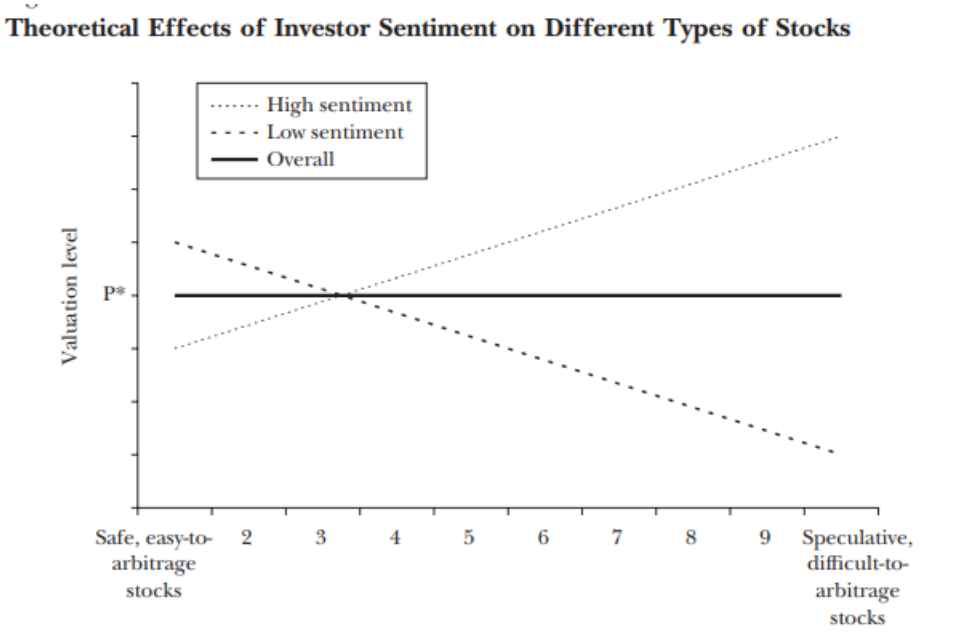
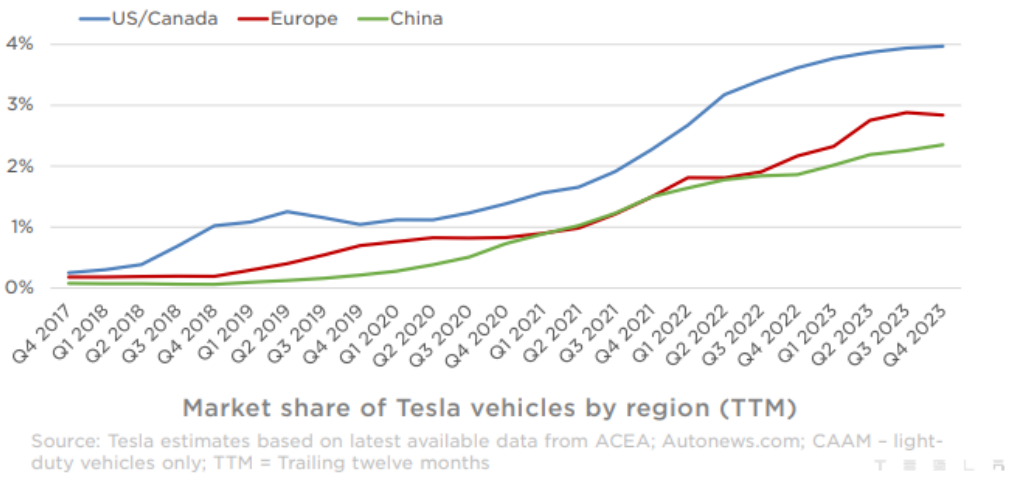
Annexes

ANNEX A: **Figure 1**. Effect of Investor Sentiment on Stock Valuation. Malcolm Baker and Jeffrey Wurgler. 2007



Note: Stocks that are speculative and difficult to value and arbitrage will have higher relative valuations when sentiment is high.

ANNEX B: **Figure 2.** Tesla Vehicle Market share per region. Tesla quarterly shareholder meeting



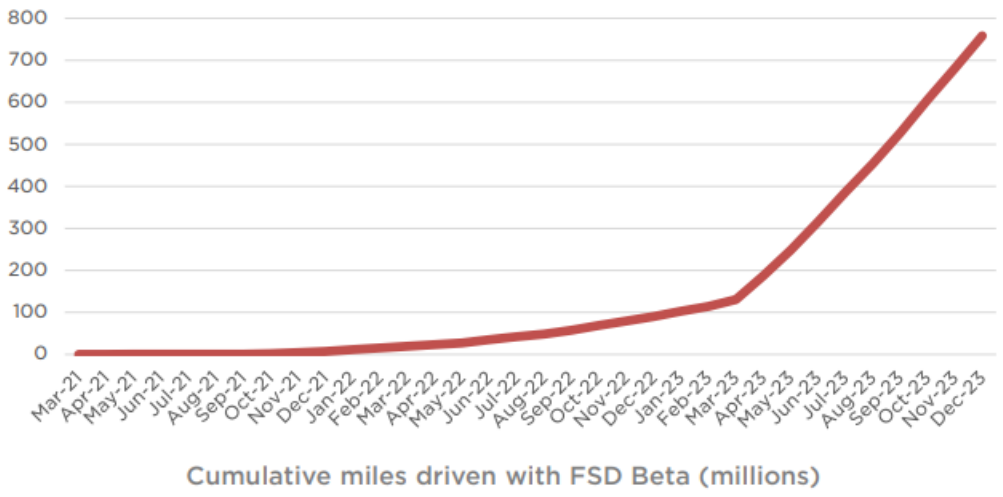
ANNEX C: **Figure 3.** Production Capacity for each Model per factory. Tesla quarterly shareholders meeting.

Current Installed Annual Vehicle Capacity

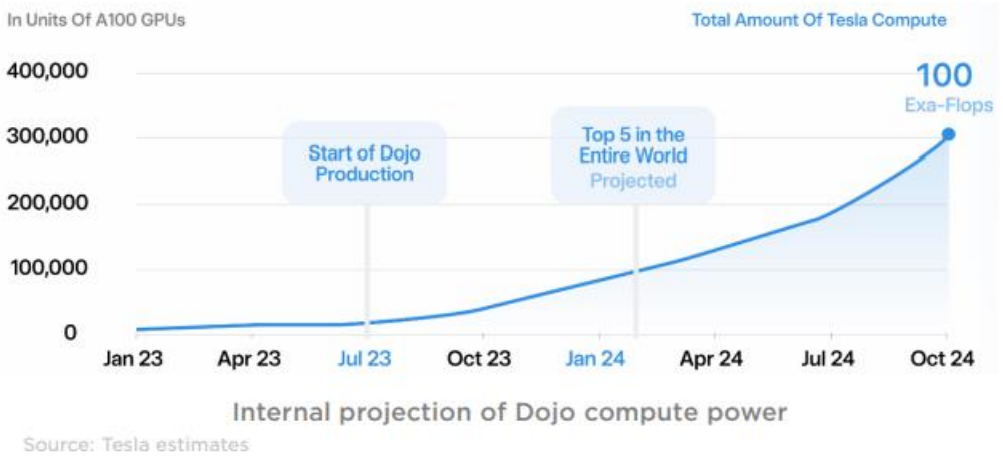
Region	Model	Capacity	Status
California	**Model S / Model X**	100,000	Production
	Model 3 / Model Y	550,000	Production
Shanghai	**Model 3 / Model Y**	>950,000	Production
Berlin	**Model Y**	375,000	Production
Texas	**Model Y**	>250,000	Production
	Cybertruck	>125,000	Production
Nevada	**Tesla Semi**	-	Pilot production
Various	**Next Gen Platform**	-	In development
TBD	**Roadster**	-	In development

Installed capacity ≠ current production rate and there may be limitations discovered as production rates approach capacity. Production rates depend on a variety of factors, including equipment uptime, component supply, downtime related to factory upgrades, regulatory considerations and other factors.

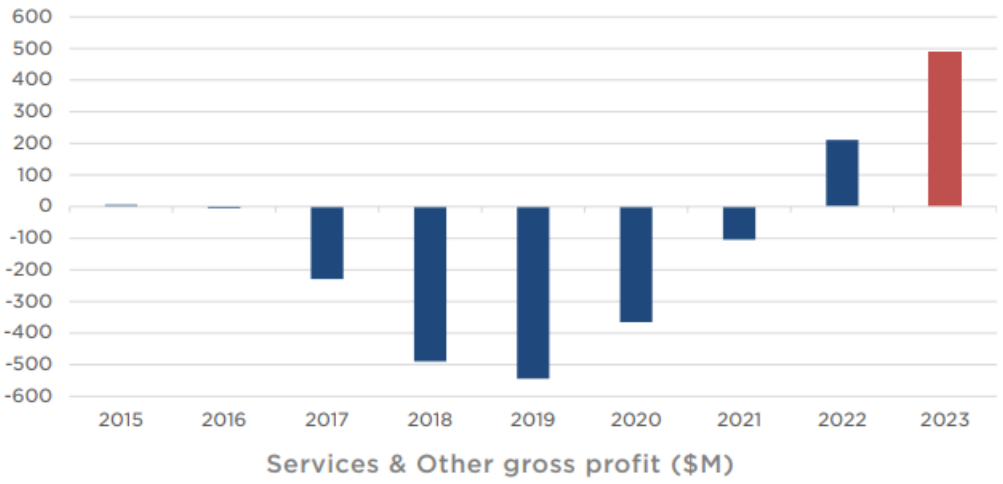
ANNEX D: **Figure 4.** Cumulative miles driven with FSD Beta. Tesla quarterly shareholders meeting



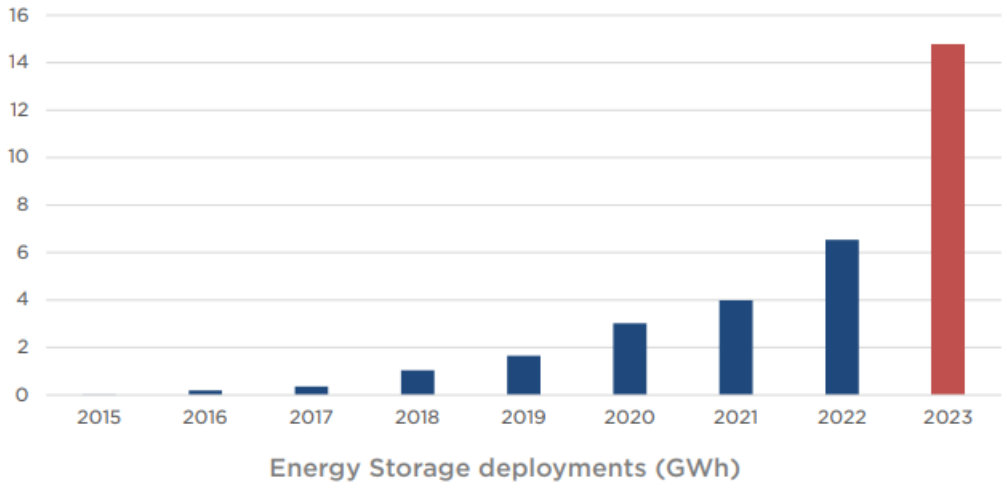
ANNEX E: **Figure 5.** Cumulative miles driven with FSD Beta. Tesla quarterly shareholders meeting



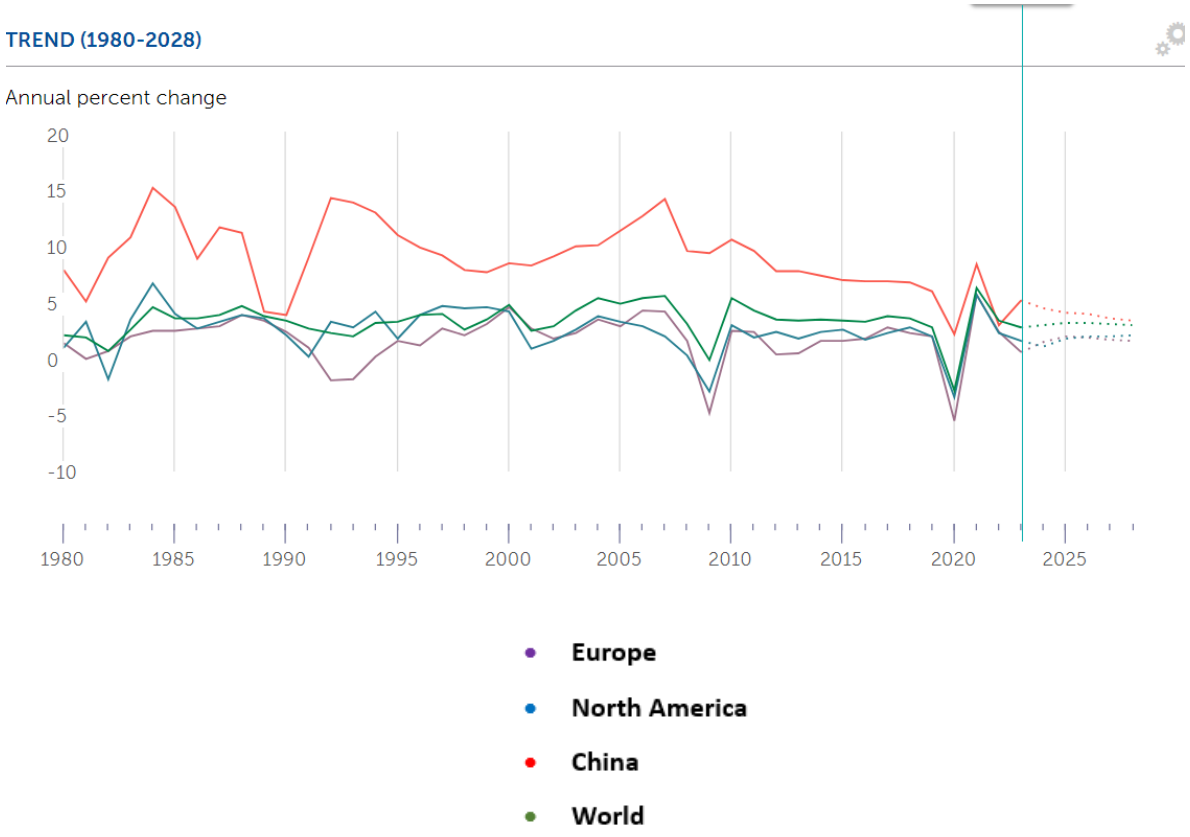
ANNEX F: **Figure 6.** Evolution of profitability of Services & Others. Tesla quarterly shareholders meeting



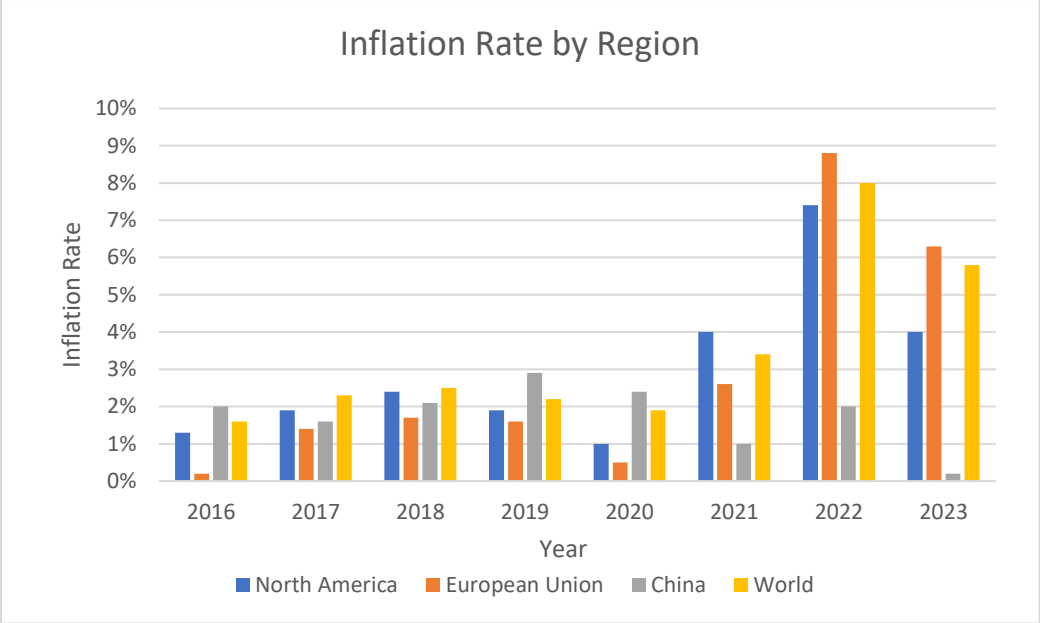
ANNEX G: **Figure 7.** Energy Storage Capacity across time. Tesla Quarterly shareholders meeting



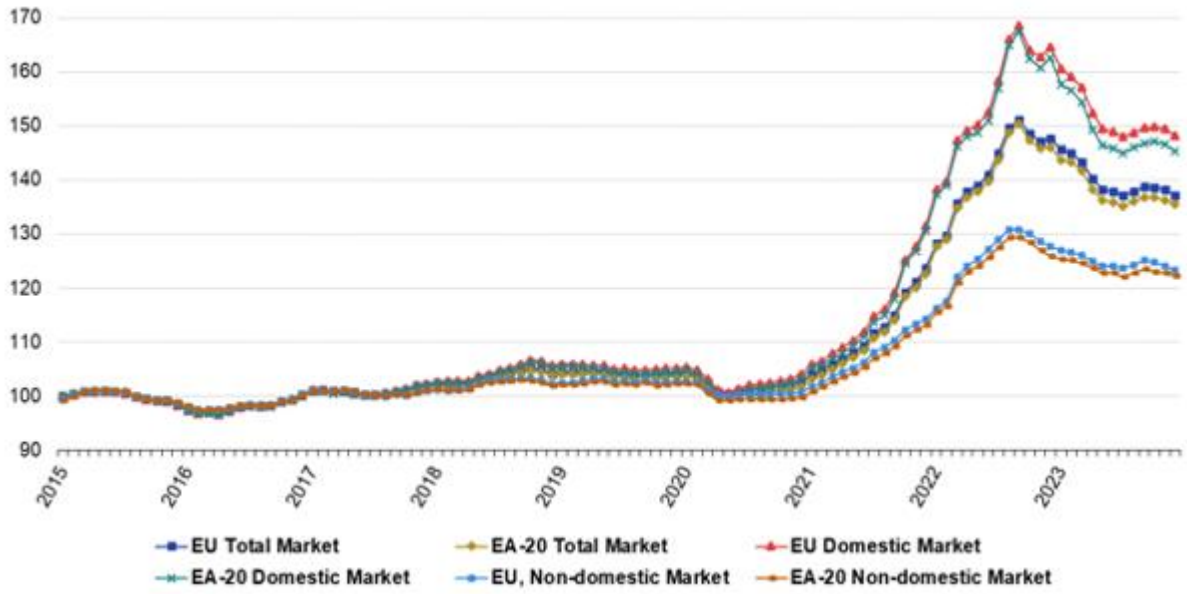
ANNEX H: **Figure 8. Real GDP Growth. Source:** IMF World Economic Outlook, 2023.



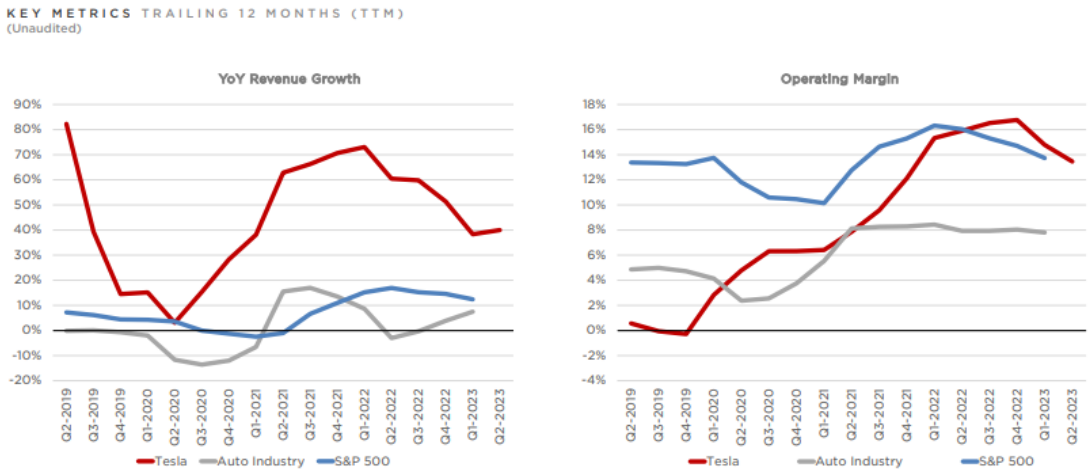
ANNEX I: **Figure 9. Inflation rate.** World Bank Group, December 2023



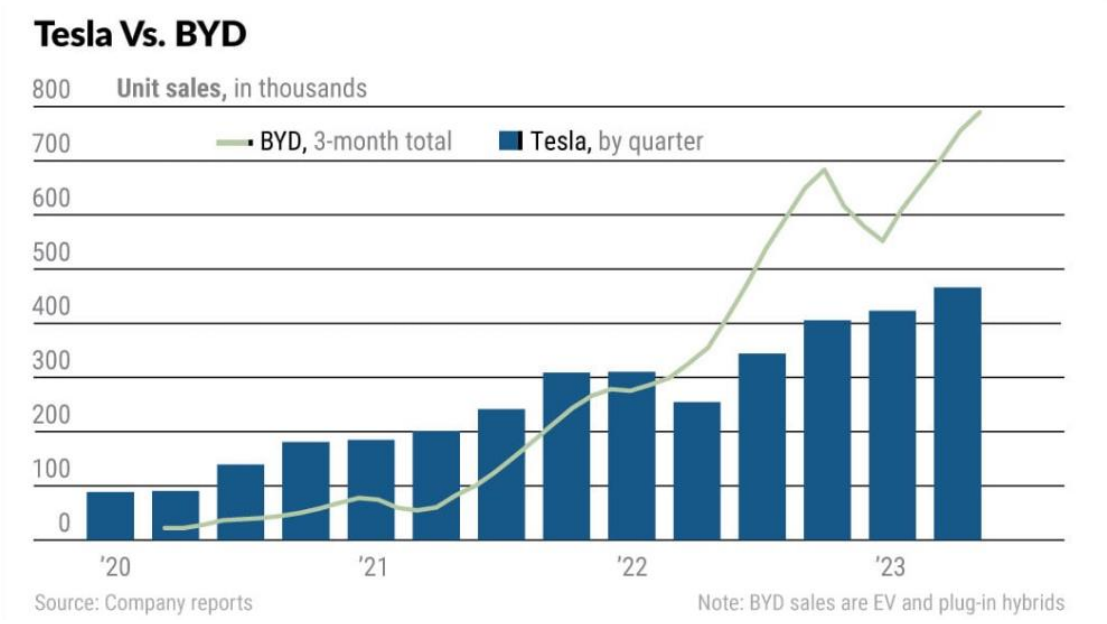
ANNEX J: Figure 10. Industrial Producer Price Index Overview. Eurostat



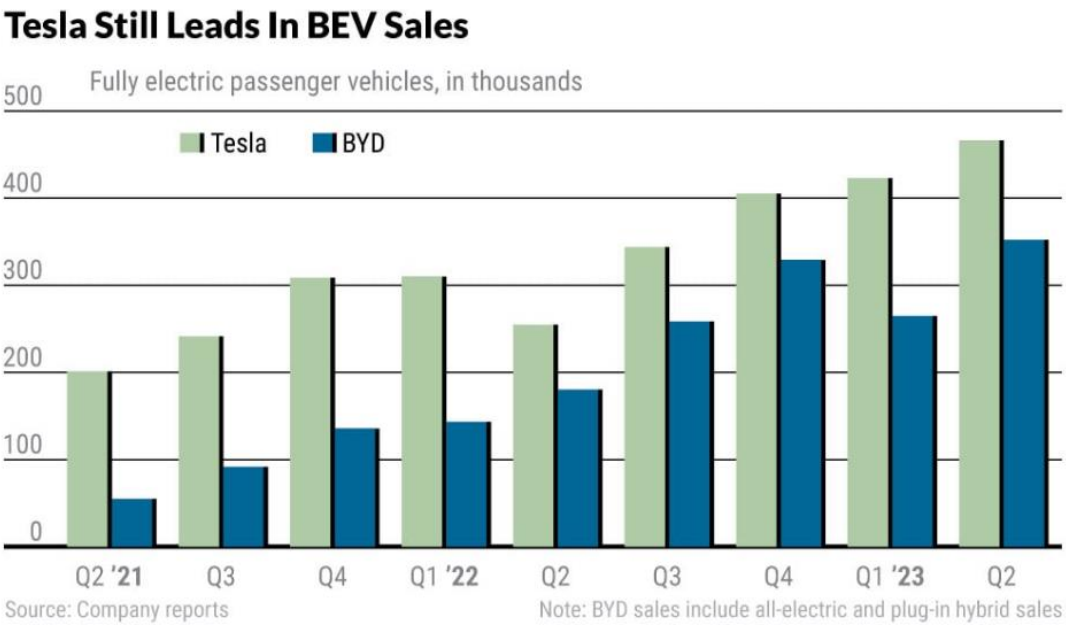
ANNEX K: **Figure 11 and 12.** Tesla's YoY Revenue Growth and Operating Margin compared with the market. Tesla quarterly shareholder meeting



ANNEX I: **Figure 13.** Comparing BYD and Tesla sales per quarter. Companies' data



ANNEX M: **Figure 14.** Comparing Electric Vehicles sales from Tesla and BYD. Companies data



ANNEX N: **Figure 15.** Autonomous Miles Run Rate between several companies developing FSD software.

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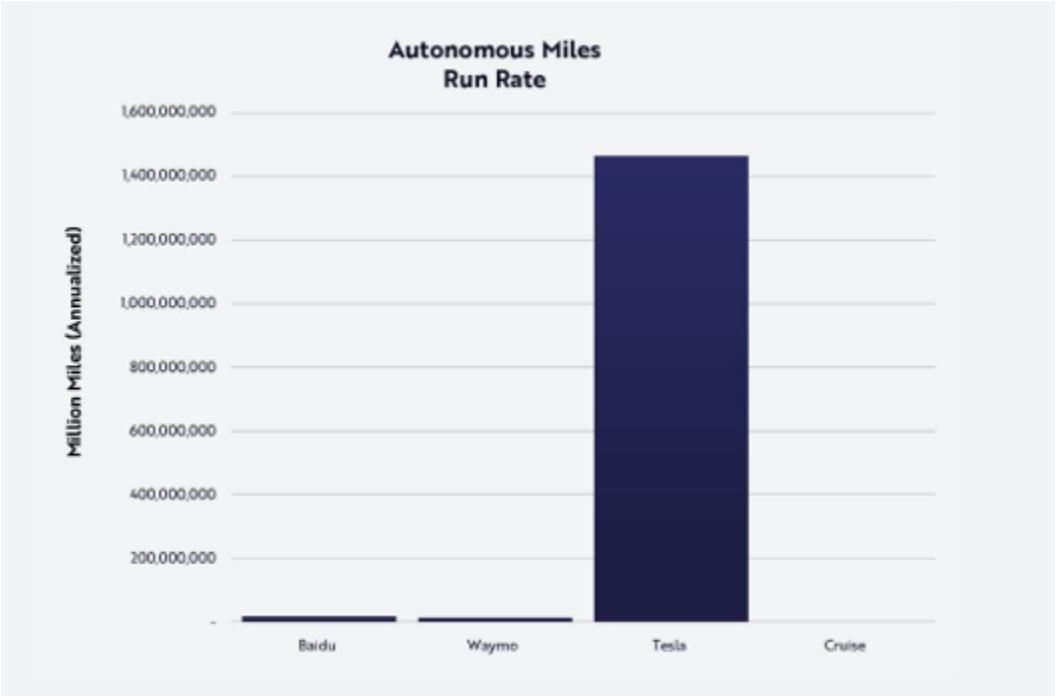

ANNEX O: **Table 1.** Profitability Ratios. Own estimates based on Tesla's and Ford's Financial Statements

Profitability ratios	2019		2020		2021		2022		2023	
	Tesla	Ford	Tesla	Ford	Tesla	Ford	Tesla	Ford	Tesla	Ford
Gross Profit Margin	16.555%	13.603%	21.024%	11.319%	25.279%	15.909%	25.598%	14.969%	18.249%	9.172%
Operating Profit Margin	-0.281%	0.368%	6.323%	-3.467%	12.069%	3.317%	16.980%	3.971%	9.187%	3.098%
Net Profit Margin	-3.153%	0.054%	2.733%	-1.004%	10.486%	13.136%	15.451%	-1.362%	15.473%	2.457%
Return on Assets	-2.259%	0.032%	1.653%	-0.477%	9.084%	6.968%	15.287%	-0.841%	14.045%	1.584%
Return on Equity	-9.556%	0.253%	3.640%	-4.141%	17.870%	36.835%	27.424%	-4.985%	23.541%	10.115%
Return on Invested Capital	-0.403%	-0.040%	4.40%	-2.619%	15.616%	2.441%	26.621%	2.459%	19.819%	3.101%

ANNEX P: **Table 2.** Liquidity Ratios. Own estimates based on Tesla's and Ford's Financial Statements

Liquidity ratios	2019		2020		2021		2022		2023	
	Tesla	Ford	Tesla	Ford	Tesla	Ford	Tesla	Ford	Tesla	Ford
Current ratio	1.135	1.202	2.008	1.201	1.375	1.201	1.532	1.202	1.726	1.196
Quick ratio	0.712	0.993	1.493	1.031	0.996	1.053	0.941	0.842	1.134	1.007
Cash ratio	0.588	0.178	1.360	0.226	0.892	0.260	0.831	0.259	1.012	0.245

ANNEX Q: **Table 3.** Solvency Ratios. Own estimates based on Tesla's and Ford's Financial Statements

Solvency ratios	2019		2020		2021		2022		2023	
	Tesla	Ford	Tesla	Ford	Tesla	Ford	Tesla	Ford	Tesla	Ford
debt-to-assets ratio	39.112%	60.618%	22.511%	60.988%	10.999%	54.267%	3.764%	54.898%	8.979%	55.288%
interest coverage ratio	-0.10073	0.562745	2.665775	-2.6699	17.50943	2.508597	72.41885	4.895476	56.99359	4.141123
equity-to-assets ratio	23.638%	12.853%	45.407%	11.528%	50.833%	18.916%	55.743%	16.870%	59.661%	15.659%
debt-to-equity ratio	165.462%	471.625%	49.576%	529.025%	21.638%	286.876%	6.752%	325.420%	15.050%	353.07%

ANNEX R: **Table 4**. Income Statement. Own estimates based on Tesla's Financial Statements

Values in Millions of $	2019	2020	2021	2022	2023	2024	2025	2026	2027
Revenue	24 578	31 536	53 823	81 462	96 773	127 295	167 444	220 256	289 725
Cost of Revenue	20 509	24 906	40 217	60 609	79 113	100 129	131 710	173 251	227 894
Gross Profit	4 069	6 630	13 606	20 853	17 660	27 166	35 734	47 005	61 830
Operating Expenses	3 906	4 636	7 083	7 197	8 769	15 695	20 646	27 157	35 722
Operating Income	163	1 994	6 523	13 656	8 891	11 471	15 089	19 848	26 108
Interest Expense	1 483	840	180	- 63	- 1 082	814	761	711	665
EBT	- 1 320	1 154	6 343	13 719	9 973	10 657	14 328	19 137	25 443
Income Tax	236	292	699	1 132	- 5 001	1 319	1 774	2 369	3 150
Income Tax Rate	17.88%	25.30%	11.02%	8.25%	-50.15%	12.38%	12.38%	12.38%	12.38%
Net Income	- 1 556	862	5 644	12 587	14 974	9 337	12 554	16 767	22 293

ANNEX S: **Table 5.** Ratios needed to infer future Cost of Revenue, Operating Expenses and Depreciations and Amortizations. Own estimates based on Tesla's Financial Statements

	2019	2020	2021	2022	2023	Average
Cost of Revenue/Revenue	83.44%	78.98%	74.72%	74.40%	81.75%	78.66%
Operating Expenses/Revenue	15.89%	14.70%	13.16%	8.83%	9.06%	12.33%
D&A/Revenue	8.76%	7.07%	5.41%	4.60%	4.82%	6.13%

ANNEX T: **Table 6.** Working Capital Calculation. Own estimates based on Tesla's Financial Statements

Working Capital Components	2019	2020	2021	2022	2023
Cash, cash equivalents and investments	6 268	19 384	17 707	22 185	29 094
Accounts Receivable, net	1 324	1 886	1 913	2 952	3 508
Inventory	3 552	4 101	5 757	12 839	13 626
Prepaid expenses and other current assets	959	1 346	1 723	2 941	3 388
Total Current Assets	12 103	26 717	27 100	40 917	49 616
Accounts payable	3 771	6 051	10 025	15 255	14 431
Accrued liabilities and other	3 222	3 855	5 719	8 205	9 080
Deferred revenue	1 163	1 458	1 447	1 747	2 864
Customer Deposits	726	752	925	0	0
Current portion of debt and finance leases	1 785	2 132	1 589	1 502	2 373
Total Current Liabilities	10 667	14 248	19 705	26 709	28 748
Working Capital	1 436	12 469	7 395	14 208	20 868

ANNEX U: **Table 7.** Calculation of future Changes in Working Capital. Own estimates based on Tesla's Financial Statements

	2019	2020	2021	2022	2023	2024	2025	2026	2027
Working Capital/Revenue	5.84%	39.54%	13.74%	17.44%	21.56%	17.58%	17.58%	17.58%	17.58%
Working Capital	1436	12469	7395	14208	20868	17013	22378	29437	38721
Changes in Working Capital		11033	-5074	6813	6660	-3855	5366	7058	9284

ANNEX V: **Table 8.** Capital Expenditure Investment Calculation. Own estimates based on Tesla's Financial Statements

Capex	2019	2020	2021	2022	2023	2024	2025	2026	2027
PP&E/Revenue	42.30%	40.42%	35.09%	28.91%	30.72%	29.82%	29.82%	29.82%	29.82%
PP&E	10 396	12 747	18 884	23 548	29 725	37959	49932	65680	86396
Net Capex		2 351	6 137	4 664	6 177	8 234	11 972	15 749	20 716
Depreciation and Amortization	2154	2 230	2 911	3 747	4 667	7807	10270	13509	17769
Capex Investment		4 581	9 048	8 411	10 844	16 042	22 242	29 257	38 485

ANNEX X: **Table 9.** Debt and Equity weights. Own estimates based on Tesla's Financial Statements

Total debt	9 573	1.20%
Market Capitalization	789 000	98.80%
Total	798 573	100.00%

ANNEX Y: **Table 10.** Cost of Equity. Own estimates based on Tesla's Financial Statements

Cost of Equity	12.30%
Risk-free rate	3.86%
Adjusted Beta	1.48
Market Risk Premium	5.70%

ANNEX W: **Table 11.** Cost of Debt. Own estimates based on Tesla's Financial Statements

Cost of Debt	9.10%
Risk-free rate	3.86%
Default spread	5.24%

ANNEX Z: **Table 12.** Weighted Average Cost of Capital

WACC	12.23%
Cost of Debt	9.10%
Weight of Debt	1.20%
Corporate tax rate	25%
Weight of Equity	98.80%
Cost of Equity	12.30%

ANNEX AA: **Table 13.** Discounted Cash Flow Valuation using FCFF. Own estimates based on Tesla's Financial Statements

Discounted Cash Flow	2023	2024	2025	2026	2027
Operating Income(1-t)	6668	8603	11317	14886	19581
Depreciation and Amortization	4667	7807	10270	13509	17769
Capex Investment	10844	16042	22242	29257	38485
Changes in Working Capital	6660	-3855	5366	7058	9284
FCFF	7151	-3487	4710	6196	8150
FCFF discounted	7151	-3106.56	3739.456	4382.841	
Continuity Value Discounted					258480.5
Enterprise Value	263496				
Non-Operating Assets	4 531				
Gross Debt	9 573				
Cash and Cash Equivalents	16 398				
Equity Value	274852				
Shares Outstanding	3 176				
Price Target ($)	86.54037				

ANNEX AB: **Table 14.** Debt predictions based on past data. Own estimates based on Tesla's Financial Statements

	2019	2020	2021	2022	2023	2024	2025	2026	2027
Debt	13419	13279	8873	5748	9573	8948	8364	7817	7307
Cost of debt	0.091								
Debt Yearly change	-6.53%								

ANNEX AC: **Table 15.** Discounted Cash Flow Valuation using FCFE. Own estimates based on Tesla's Financial Statements

DCF-Equity	2023	2024	2025	2026	2027
FCFF	7151	-3487	4710	6196	8150
Debt Variation	-3825	625	584	546	510
Interest Expense	-1082	814	761	711	665
FCFE	4408	-3676	4533	6031	7996
FCFE Discounted	4408	-3274	3595	4259	
Continuity Value Discounted					245914
Present Value of FCFE	250493.97				
Non-Operating Assets	4 531				
Equity Value	255024.97				
Price Target	80.297535				

ANNEX AD: **Table 16.** Sensitivity Analysis for the FCFF approach. Own estimates based on Tesla's Financial Statements

		WACC				
Stock Price	86.54037	11.50%	12%	**12.23%**	12.50%	13%
g	11%	375.42	187.8124	152.6851	125.2895	94.03751
	10.50%	190.3056	126.9304	110.0566	95.25252	76.25351
	10%	128.6008	96.48932	86.5404	77.23034	64.39751
	9.50%	97.74839	78.22469	71.63686	65.21556	55.92893
	9%	79.23695	66.04828	61.34685	56.63357	49.57751

ANNEX AE: **Table 17.** Sensitivity Analysis for the FCFE approach. Own estimates based on Tesla's Financial Statements

		Re				
Stock price	80.29754	11.50%	12%	**12.30%**	12.50%	13%
g	11%	366.1292	182.0725	140.042	120.7334	90.07344
	10.50%	184.5178	122.3425	101.8535	91.26482	72.62598
	10%	123.9807	92.47755	80.29754	73.58369	60.99434
	9.50%	93.71214	74.55856	66.45117	61.79627	52.68603
	9%	75.551	62.61257	56.80577	53.37668	46.45479

ANNEX AF: **Table 18.** Future Operating Income and NOPAT values. Own estimates based on Tesla's Financial Statements

	2023	2024	2025	2026	2027
Operating Income	8891	11471	15089	19848	26108
NOPAT	13337	11999	15783	20761	27309
WACC	12.23%				

ANNEX AG: **Table 19.** Effective Tax Rate Evolution. Own estimates based on Tesla's Financial Statements

	2019	2020	2021	2022	2023	2024	2025	2026	2027
Effective Tax Rate	-17%	25%	11%	8%	-50%	-4.60%	-4.60%	-4.60%	-4.60%

ANNEX AH: **Table 20.** Evolution of the YOY change of Invested Capital. Own estimates based on Tesla's Financial Statements

	2020	2021	2022	2023	2024	2025	2026	2027
Invested Capital	32 496	35 531	46 749	67 291	80721	96832	116159	139343
Invested Capital YOY change	19.96%							

ANNEX AI: **Table 21.** Valuation using the EVA method. Own estimates based on Tesla's Financial Statements

	2023	2024	2025	2026	2027
EVA	5107	2126	3940	6554	10267
EVA Discounted	5 107	1894	3128	4637	
Continuity Value Discounted					325625
MVA	335284				
Invested Capital	67 291				
Enterprise Value	402 575				
Non-Operating Assets	4 531				
Firm Value	407 106				
Gross Debt	9 573				
Equity Value	397 533				
Price Target ($)	125.1679				

ANNEX AJ: **Table 22.** Data and Multiples Ratios for several automotive companies. Own estimates based on the companies' Financial Statements

	Data								Ratios		
Company	Stock price	Shares Outstanding	Market Capitaliztion	Total Debt	Cash and Cash Equivalents	Enterprise Value	Revenue	EBITDA	Price/Revenue	EV/Revenue	EV/EBITDA
Tesla	248.48	3168250	787246760	9573000	29094000	767725760	106618000	14796000	7.383807237	7.2007143	51.88739
Ford	11.87	4000500	47485935	151107000	28720000	169872935	176191000	11808000	0.269513965	0.9641408	14.38626
GM	35.92	1391750	49991660	122648000	21170000	151469660	171842000	23202000	0.290916423	0.8814473	6.528302
Lucid	4.21	1936513	8152720	2348469	4420000	6081189	695833	-2399965	11.71648906	8.7394371	-2.533866
BYD	27.87	2909032	81080540	2837743	8628100	75290183	75224191	4765397	1.077851931	1.0008773	15.79935

ANNEX AK: **Table 23**. Median and Average Ratios of the ratios for the companies analyzed.

	Price/Revenue	EV/Revenue	EV/EBITDA
Median	0.684384177	0.982509	10.45728
Average	3.338692844	2.8964756	8.545012

ANNEX AL: **Table 24 and 25.** Stock value for Tesla using 3 different ratios

Relative Valuation	EV/Revenue	EV/EBITDA
Implied EV	308816437	154725914
Total Debt	9573000	9573000
Cash	29094000	29094000
Implied Market Cap	328337437	174246914
Shares Outstanding	3168250	3168250
Implied Stock Price	103.633689	54.99784242

Relative Valuation	Price/Revenue
Implied Market Cap	355964754
Shares Outstanding	3168250
Implied Stock price	112.3537453

ANNEX AM: **Table 26.** Introduction of Nvidia on Table 22. Own estimates based on the companies' Financial Statements

	Data								Ratios		
Company	Stock price	Shares Outstanding	Market Capitaliztion	Total Debt	Cash and Cash Equivalents	Enterprise Value	Revenue	EBITDA	Price/Revenue	EV/Revenue	EV/EBITDA
Tesla	248.48	3168250	787246760	9573000	29094000	767725760	106618000	14796000	7.383807237	7.2007143	51.88739
Ford	11.87	4000500	47485935	151107000	28720000	169872935	176191000	11808000	0.269513965	0.9641408	14.38626
GM	35.92	1391750	49991660	122648000	21170000	151469660	171842000	23202000	0.290916423	0.8814473	6.528302
Lucid	4.21	1936513	8152720	2348469	4420000	6081189	695833	-2399965	11.71648906	8.7394371	-2.533866
BYD	27.87	2909032	81080540	2837743	8628100	75290183	75224191	4765397	1.077851931	1.0008773	15.79935
Nvidia	495.2	2468000	1222153600	11056000	7280000	1225929600	60922000	7340000	20.06095663	20.122938	167.0204

ANNEX AN: **Table 27**. Median and Average Ratios of the ratios for the companies analyzed.

	Price/Revenue	EV/Revenue	EV/EBITDA
Median	1.077851931	1.0008773	14.38626
Average	6.683145602	6.341768	40.24009

ANNEX AO: **Table 28 and 29.** Stock value for Tesla using 3 different ratios

Relative Valuation	Price/Revenue
Implied Market Cap	712543618
Shares Outstanding	3168250
Implied Stock price	224.9013234

Relative Valuation	EV/Revenue	EV/EBITDA
Implied EV	676146620	595392305
Total Debt	9573000	9573000
Cash	29094000	29094000
Implied Market Cap	695667620	614913305
Shares Outstanding	3168250	3168250
Implied Stock Price	219.574724	194.0861059

ANNEX AP: **Table 30 and 31.** Stock value for Tesla using 3 different ratios but with just Nvidia data.

Relative Valuation	Price/Revenue
Implied Market Cap	2138859074
Shares Outstanding	3168250
Implied Stock price	675.0916355

Relative Valuation	EV/Revenue	EV/EBITDA
Implied EV	2145467353	2471233564
Total Debt	9573000	9573000
Cash	29094000	29094000
Implied Market Cap	2164988353	2490754564
Shares Outstanding	3168250	3168250
Implied Stock Price	683.338863	786.1609924

ANNEX AQ: **Figure 17.** Investment profitability comparison between Tesla and the S&P 500. PortfoliosLab

ANNEX AR: **Figure 18.** Comparison between stock price and trading volume. Own analysis based on public data.