Tesia, Inc.: The Automotive Business Analysis

Senior Honors Thesis

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Executive Summary

Tesla, Inc. is the first carmaker to convince the world that electric cars can compete with gasoline-powered cars. The company has not only revolutionized the global automotive industry, but also spurred substantial investments into electric vehicle programs by the largest automobile manufacturers. Despite its success accelerating the world’s inevitable transition to sustainable transport, Tesla has not yet proven the economic potential of manufacturing and selling electric vehicles.

Tesla continues to be a money-losing entity focused mainly on rapid growth. In addition, due to the nature of automotive industry, the electric carmaker constantly requires infusions of fresh capital in order to support its growth plans. The company tends to push the envelope in terms of new product development, thus causing frequent delays and other product-related issues. Nevertheless, the market has been willing to accept all the current losses in return for potential future profits. Correspondingly, the primary goal of this paper is to evaluate the long-term prospects of Tesla, Inc.

Due to immaturity of electric powertrain technology, most competitors have been reluctant to enter the electric vehicle segment. These large, deep-pocketed companies have enough resources to crush Tesla once and for all, but choose not to do so in order to protect their profit margins. Because direct competition is virtually nonexistent in the high-end electric vehicle market, the potential impact of external factors on the company is disregarded for the most part.

The current internal problems of Tesla are prioritized in this paper. Based on my research and analysis, the company’s inability to improve the automotive gross margin over time is the one of the main causes of continuous losses. The operating expenses such as SG&A and R&D are, in fact, more efficient compared to other car manufacturers. At the same time, the automotive gross margin of Tesla is being squeezed from both the cost and revenue sides. The company does not make an impression of a lean manufacturer: in addition to occasional reliability issues, Tesla vehicles have many defects associated with a poor build quality; the company tends to rush the production ramp-ups of the new
models, thus compromising on the initial quality and driving the costs up; the supply chain of Tesla resembles the typical mass-production supply system; the inventory management is highly inefficient; and, despite efforts to automate the Tesla Factory, the production process involves significant amount of manual labor, [potentially] causing build quality issues and increasing labor costs. All these issues lead to an inefficient manufacturing process which causes the margins to shrink. The UBS research report\(^1\) suggests that the costs to build comparable electric and conventional vehicles are closer than ever. However, other luxury automakers are able to achieve significantly higher margins than Tesla. This brings me to the second part of the profit equation. Instead of charging a large premium, Tesla sets relatively competitive prices for its vehicles, thus putting an additional downward pressure on the margins. Despite the importance of getting the pricing right, I do not conduct a deep analysis of Tesla’s choice of the pricing strategy because the company seems reluctant to ever change it. Instead, leaning the production system is emphasized.

Many reasons lead me to believe that Tesla has a viable business proposition. First, the company has successfully adopted the direct sales model which is superior to the traditional dealership model. The actual savings are modest at the current volume of sales, but are supposed to become more pronounced as the revenues grow. Second, Tesla is the first automaker to take the issue of electric vehicle charging seriously. The extensive and constantly growing network of Supercharger stations differentiates Tesla from the rest of auto manufacturers. Third, the company has been able to build a strong brand in a short period of time. While several aspects of the company define its brand image, design of Tesla cars stands out for me personally. Fourth, Tesla has already demonstrated that its product development process is extremely efficient. By leveraging the existing technology in subsequent models and limiting the product lineup, the

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\(^1\) This report is a comprehensive study of the new mass-market electric vehicles, Chevy Bolt EV and Tesla Model 3. A team of researchers from the Swiss financial giant UBS took apart a Chevy Bolt in order to conduct an in-depth cost analysis of the vehicle.
company tends to spend less on the development of new vehicles. Last but not least, one of the key findings of my paper is that electric vehicles will soon become superior to conventional vehicles. They not only decrease the amount of CO₂ emissions (the car becomes a truly zero-emission vehicle, when the driver uses solar energy to charge his vehicle), but also are cheaper to maintain and operate. In addition, expanding charging infrastructure and inevitable advancements in the fast-charging technology will make the recharging process as ubiquitous, simple and quick as filling up a gas tank. All in all, regardless of what competitors do in the next few years, these advantages position Tesla perfectly for the long-term success.

Multiple challenges such as unionization of the Tesla Factory, elimination of governmental subsidies, and intensified competition in the electric vehicle market are likely to be just around the corner for Tesla. In order to face them successfully, the electric carmaker needs to achieve economies of scale in the most efficient manner. Low capital utilization rate, poor fixed cost coverage, and wasteful manufacturing processes are among the main issues Tesla has to continuously tackle. Furthermore, the importance of implementing the lean production system will rise with scale. Although the rate of improvement in operational efficiency has slowed down over the last few years, Tesla can compete with other auto manufacturers in the long run as long as the current internal problems are taken care of in the short run.
Background, History and Business Description

Since the beginning of the 20th century the amount of greenhouse gases in the atmosphere has been rising rapidly. Greenhouse gases include, but are not limited to, carbon dioxide (CO₂), water vapor, methane, ozone and nitrous oxide. In essence, increasing concentrations of these gases contribute to the greenhouse effect – warming that results when the atmosphere traps heat radiating from Earth toward space – which is the primary cause of the climate change and the global warming (Callery, 2017). It is important to note that CO₂ is not only the most abundant greenhouse gas in the atmosphere, but also stays there for the longest period of time – often more than 100 years – compared to other greenhouse gases (Union of Concerned Scientists 2017). Although the issue has not been recognized on the global stage until late in the 20th century, most developed countries have recently initiated extensive programs aimed at reducing CO₂ emissions. Because automobiles are responsible for a significant part of CO₂ emissions (16 percent in the world; 32 percent in the United States), the beginning of the new millennium has been marked by an introduction of new regulations for automobile manufacturers. The world’s largest automakers have responded by improving fuel efficiency of gasoline-powered cars (also called conventional vehicles), developing hybrid vehicles, and starting electric vehicle programs. While some companies achieved major breakthroughs in improving the efficiency of their conventional vehicles (Mazda, Volkswagen), others developed appealing hybrid vehicles (Toyota, Honda). But creating a good electric car turned out to be a problematic task for the large automobile manufacturers. The unsuccessful attempt of General Motors to bring the EV-1 to market

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2 According to the Environmental Protection Agency, CO₂ accounted for 76% of the global greenhouse gas emissions in 2012 (Ritchie – Roser).
3 The Kyoto Protocol was adopted in Kyoto, Japan, in December 1997. Under Kyoto, developed nations (excluding the United States) pledged to reduce their yearly emissions of carbon, as measured in six greenhouse gases, by an average of 5.2%. The Protocol entered into force in February 2005 (Henson, 2011).
was one of the most prominent failures. In addition to a lack of adequate charging infrastructure and immaturity of battery technology, electric vehicles were uncompetitive and only attracted “green” customers.

Eager to solve these problems, Martin Eberhard and Marc Tarpenning founded Tesla Motors, Inc. (later renamed to Tesla, Inc.) in July 2003. Elon Musk, Ian Wright, and JB Straubel joined the company shortly thereafter. Fast-forward to late 2017, and Tesla has already sold more than 250,000 vehicles around the world, opened hundreds of company-owned stores and service centers, built the largest network of fast-charging stations, unveiled a long-awaited mass-market vehicle, and introduced a new version of Autopilot with a full self-driving capability. Tesla’s history (see Exhibit 1) can also be referred to as the modern history of electric vehicles. Despite its young age and relatively small size, Tesla managed to disrupt the auto industry and change the public’s perception of electric vehicles. Nevertheless, many of Tesla’s accomplishments would not be feasible without the key partnerships formed with four well-established companies: Lotus Cars, Toyota Motor Corporation, Daimler AG and Panasonic Corporation.

At the time of founding Tesla Motors, neither Martin Eberhard, nor Marc Tarpenning had any prior experience building cars. Therefore, in order to fill this gap, they partnered with Lotus⁴ – a boutique British carmaker known for designing and building lightweight sports cars with exceptional handling characteristics. Tesla Roadster, the first electric vehicle developed by Tesla, was based on the Lotus Elise. In addition to collaborating with Lotus engineers on the design and development of the Roadster, Tesla also outsourced manufacturing of its first production vehicle to Lotus. Because of limited amount of funding, the fledgling American company could not afford building a new factory from scratch. Luckily for Tesla, the Great Recession hit the U.S. [and the global] economy late in 2007. The auto industry in the United States has historically been more cyclical than in other major regions of the world. Unsurprisingly, sales of new cars in the

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⁴ Interestingly, Eberhard briefly considered going after Porsche, but the German automaker’s rate was three times that of Lotus (Baer, 2014).
U.S. went down dramatically in the following years resulting in excessive capacity for the largest auto manufacturers. Several factories across the country ceased operations during the recession, including the New United Motor Manufacturing, Inc. (NUMMI) – one of the largest auto manufacturing plants in the United States – which was shut down by Toyota Motor Corporation (TMC) early in 2010. NUMMI’s opportune size and strategically advantageous location attracted Tesla as a potential buyer. After a few months of negotiations, TMC not only accepted Tesla’s offer to purchase a significant part of the NUMMI facility\(^5\) for $42 million, but also decided to establish an official partnership with Tesla (Hull, 2010). The two companies announced their intention to cooperate on the development of electric vehicles. In addition, Toyota agreed to purchase $50 million worth of Tesla’s common stock issued in a private placement. The same pattern was followed by Daimler AG a few years earlier. The German automaker started collaborating with Tesla in late 2007 and subsequently acquired an equity stake of nearly 10 percent of Tesla Motors for $50 million in May 2009. To summarize, these partnerships allowed Tesla to (1) avoid common pitfalls of the automotive industry and gain expertise in the design and development of cars, (2) generate revenue through development services and sales of electric powertrains, and (3) raise additional capital needed for funding further expansion of the company.

One cannot underestimate the importance of having partnerships with industry leaders. However, albeit mutually beneficial, relationships with Lotus, Daimler and Toyota did not last long\(^6\). In contrast, Tesla’s partnership with Panasonic Corporation –

\(^5\) The entire NUMMI facility covers about 370 acres. Tesla bought only 210 acres, a parcel that contains several buildings that have approximately 5.5 million square feet of floor space.

\(^6\) Tesla chose not to extend the contract for production of the Roadster beyond 2,450 vehicles. The company ended the relationship with Lotus and discontinued the luxury sports car in order to focus entirely on bringing the more affordable Model S sedan to market. Instead of extending their contracts with Tesla (related to Mercedes-Benz B-Class and Toyota Rav4 EV), Daimler and Toyota decided to bring the development of subsequent electric vehicles in-house.
the world’s leading battery cell manufacturer – proved to be more successful. In January 2010, Tesla and Panasonic united to accelerate the development of the next generation EV battery cells. Later that year, Panasonic invested $30 million in Tesla. Panasonic played a major role in the advance of the electric car manufacturer. Over the years of collaboration, the Japanese company not only served as a single-source supplier of battery cells, but also ensured continuous improvement of its products. Currently, Panasonic remains Tesla’s only strategically important long-term partner.

While strategic partnerships played a crucial role in the beginning, technological and business model innovations have been responsible for Tesla’s continued success. These innovations stem from the early decision to be a significantly more vertically integrated company compared to other original equipment manufacturers (OEMs). First of all, Tesla invests heavily in research and development in order to remain independent of suppliers in key areas of its business operations. For example, the company has recently taken the development of the Autopilot technology in-house due to supplier issues (Geuss, 2016). Second, Tesla does not offer a wide range of products, thus decreasing the development costs and reducing the possibility of sales cannibalization. Based on Elon Musk’s recent public statements, there are no plans to extend the product line beyond seven vehicles\(^7\) in the near future. It is a common practice for large OEMs to sell dozens of different models in order to stay competitive. Third, Tesla utilizes a direct sales model which is illegal in certain U.S. states. On the one hand, eliminating dealers’ margins from the equation is presumed to benefit both the customer and the seller. However, on the other hand, this model substantially increases SG&A costs and causes frequent litigation against dealers and dealer associations. In any case, despite having evident shortcomings, the traditional dealership sales model has not been altered for more than a century and Tesla is not

\(^7\) Currently, Tesla sells three different vehicles: Model S, Model X and Model 3. The company has already unveiled the Tesla Semi heavy-duty truck and the next-generation Roadster. In addition, there are plans to launch a Model Y crossover and a Tesla pickup truck.
content with the status quo. Lastly, in contrast to drivers of other EVs, Tesla customers have access to an extensive network of Supercharger stations which is expanding rapidly. All in all, current and future success of this company is predicated on finding alternative ways of doing business more efficiently in a highly competitive automotive industry. In order to get a deeper understanding of the company’s decisions and reasons underlying them, I discuss the main aspects of Tesla’s business model in greater detail in Part II of this paper. I believe that a combination of technological and business model innovations drives the value of the company up and serves as a major source of sustainable competitive advantages for Tesla, Inc.
Introduction

According to the company’s website, “Tesla’s mission is to accelerate the world’s transition to sustainable energy”. In other words, rephrasing this mission statement in the context of this paper, Tesla’s mission is to turn around a $2.3 trillion global automotive industry by propelling the development and adoption of electric vehicles around the globe – a very bold and ambitious mission (Peters, 2017).

Before delving deeper into the analysis of the company, I would like to mention Elon Musk’s famous “All Our Patent Are Belong To You” blog post and its [nonexistent] consequences. In the blog post, the CEO of Tesla announced that his company will not initiate lawsuits against anyone who, in good faith, wants to use its technology. Consistent with the company’s mission statement, the purpose of this Patent Pledge was the advancement of electric vehicle technology. Nonetheless, the “in good faith” provision prevented other OEMs from taking advantage of Tesla’s technology – in order to use Tesla’s patents for free, a company must forfeit its right to sue Tesla for infringement of its own patents. In addition, collaborations with Daimler and Toyota have revealed numerous difficulties associated with application of Tesla’s technologies in other vehicles. In essence, while small startups can potentially benefit from such an arrangement, large carmakers cannot afford undermining the future value of their own research and development efforts. As a result, more than three years after the announcement, there is no single official report of any company using Tesla’s patents.

Did Tesla misjudge the value of its patent portfolio? – Apparently. Did Elon Musk anticipate such an outcome? – Probably. Interestingly, despite the possibility of losing one of the company’s competitive advantages, Musk was not concerned about intensified

8 Visit Tesla’s website for a detailed description of the Patent Pledge: https://www.tesla.com/about/legal#patent-pledge
9 In one of his interviews Elon Musk claimed to have been contacted by other companies regarding the Patent Pledge. Because he did not identify these companies, I find it hard to believe this statement (Lambert, 2015).
competition in the electric vehicle market. In my opinion, he and his team were well aware of the fact that it takes more than a few patents to develop a compelling electric vehicle. And the Patent Pledge was not a noble effort to “accelerate the world’s transition to sustainable energy”, but rather a successful attempt to improve the brand image and increase the stock price.

Generally, companies should be encouraged to look for creative ways to generate positive publicity, but Tesla’s methods are not sustainable. I discussed the Patent Pledge at length in order to demonstrate one of many instances when the company was not entirely transparent in its statements. The company’s public relations strategy is quite controversial. Its main focus is maintaining an elevated stock price. For instance, instead of following the industry standard of reporting monthly production figures, Tesla prefers to madden the analysts by providing only quarterly data. The company tends to deny all negative reports associated with the company and its products, but enjoys riding the wave of positive publicity (early issues associated with the Roadster vs. multiple awards won by the Model S). For the reasons listed above, I conclude that all publicly available information related to Tesla (including the SEC filings) should be perceived with a certain amount of skepticism.

On February 15, 2012, Elon Musk claimed for the first time that the company “will not need to ever raise another funding round” (Voelcker, 2012). Unsurprisingly, Tesla had to raise debt or equity ten times during the last five years. In addition, a large portion of employee compensation at all levels of the organization comes in the form of equity. In other words, the company’s ability to not only raise cash on favorable terms, but also retain engineering talent largely depends on the stock price. As a result, Tesla has a long history of overpromising and underdelivering. Sometimes, executives may “go too far” in their attempts to influence public’s opinion in one way or another. While this approach is effective during the good times, it can backfire when the things are not going well. Looking at the most recent events, I consider the company’s public relations strategy to be responsible for numerous lawsuits and complaints filed against Tesla (discussed later
in Part III of the paper). Moreover, in response to poor quarterly results, most analysts turned against the company, thus pushing the stock price further down. Despite all this negative publicity, I attempt to analyze the company from a neutral standpoint. Throughout its brief history, Tesla has demonstrated a remarkable progress towards achieving its objectives, but the company remains unprofitable and cash flow negative. The purpose of this paper is to (1) determine the main issues faced by Tesla which can undermine the value of the company and put its future at risk, (2) find the root causes thereof using both quantitative and qualitative analysis of the available information, and, when appropriate, (3) make recommendations.

**Part I: Financial Analysis**

Earnings power is a key determinant of a company’s market value in the automotive industry. In contrast, market value of Tesla is based on expectations of future earnings. This is one of the reasons why Tesla is often referred to as a tech company rather than a car company. With regard to the current results, Tesla is on the verge of its first 10-year anniversary of year-end losses. Therefore, a basic profitability analysis is a logical starting point of the financial analysis.

1. **Income Statement**

   Using data from the annual reports of Toyota, Daimler and General Motors, I compare operational results of these companies with Tesla for the last seven years. The method of this analysis is straightforward – each component of the income statement (see Exhibit 2) is evaluated separately as a percentage of total revenue. It is worth mentioning that line-by-line comparisons are not always possible because of a different business model adopted by Tesla. For example, SG&A expenses are disproportionately

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10 Even though the focus of this paper is the automotive segment, total revenues are used for calculating percentages because certain expenses (SG&A and R&D) are attributable to all segments of the company.
larger for Tesla because of the direct sales model. Despite some limitations\textsuperscript{11}, benchmarking against industry leaders helps reveal key areas of Tesla’s business where the company is lagging behind competition. Consequently, this allows me to draw conclusions about the operational efficiency of Tesla.

\textit{Automotive revenue}

Although revenues generated through sales of energy storage products and solar panels are growing rapidly, automotive segment remains the core business of Tesla, Inc., representing more than 90 percent of total revenues. Obviously, automotive revenues depend primarily on the base prices of the vehicles and the prices of additional options. Tesla is known as a luxury carmaker with luxury prices. However, further examination revealed that the company used competitive pricing strategy with each of its vehicles. To begin with, I analyze the pricing strategy of the Roadster.

Here is an excerpt from one of the company’s blog posts: “We chose to make a sports car first because we can justify the relatively high price of new technology from a new company by also offering great performance. $89K – $100K is reasonable for a sports car that performs as ours does.” Indeed, as Figure 1 below demonstrates, Tesla offered its customers a price comparable to other vehicles in that market segment. Initially, the base price for the Roadster was $98,000 and several vehicles were sold at that price. However, due to higher-than-anticipated costs, Tesla had to increase the base price to $109,000. Customers who ordered the Roadster in advance had to either agree to a new price, or cancel their orders. Interestingly, despite many issues associated with the Roadster, Tesla sold all cars planned for production. This fact implies that most people interested in purchasing the Roadster were not price sensitive. The company could set a higher price from the beginning without risk of losing many customers. In doing so, Tesla would not only improve its financial situation, but also avoid the negative reaction from the public.

\textsuperscript{11} In addition, I ignore the fact that Toyota Motor Corporation’s fiscal year ends on March 31\textsuperscript{st} instead of December 31\textsuperscript{st}.
caused by the price increase of the Roadster. And, most importantly, this would allow the company to set higher base prices for its subsequent vehicles, Model S and Model X.

*Figure 1*

<table>
<thead>
<tr>
<th>Tesla Roadster competition in 2011, base prices</th>
</tr>
</thead>
<tbody>
<tr>
<td>$109,000</td>
</tr>
<tr>
<td>Tesla Roadster ($98,000 in 2008)</td>
</tr>
</tbody>
</table>

Source: Compiled by author using online search engine.

With regard to the Model S, the company had to set a significantly lower base price for its second-generation vehicle in order to demonstrate improvements in the battery and electric powertrain technologies. Initially, Tesla advertised the Model S as a luxury sedan which would have a base price below $50,000 mark ($49,900 after $7,500 federal tax credit). What Tesla did not advertise was the size of the battery pack – only 40 kWh capable of a maximum range of 160 miles on a single charge. In other words, the company had to decrease the size of the battery pack substantially in order to avoid losing money on every vehicle sold. In any case, that version of the Model S was later discontinued.

Going back to the Roadster, I believe that the company did not get the pricing of its first vehicle right. And this blunder had a far-reaching impact on the bottom line. Given that a vast majority of Tesla customers are wealthy individuals (approximately 80% of
Tesla owners make more than $100,000 a year), it is reasonable to infer that a $5,000 increase in the average price of the vehicles sold would not have a significant impact on demand (Polk, 2016). Moreover, had the company decided to lower the prices afterwards, the result would be a favorable market reaction. Another reason for Tesla to reconsider its pricing strategy is the cost to manufacture electric vehicles. Based on several reports from unrelated sources, the electric vehicle technology is projected to reach parity with conventional vehicles in 10-15 years from today. The objective of selling desirable electric vehicles at reasonable prices is understandable and even admirable. However, the main goal of a public entity must be profit generation. Figure 2 and Figure 3 compare the prices of Model S and Model X to competition, respectively. Because both vehicles are priced similarly to their gasoline-powered counterparts, Tesla is unable to reach the same gross and profit margins as other luxury carmakers.

**Figure 2**

<table>
<thead>
<tr>
<th>Model</th>
<th>Base Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tesla Model S (60 kWh)</td>
<td>$74,400</td>
</tr>
<tr>
<td>Mercedes-Benz CLS-Class (CLS400)</td>
<td>$64,228</td>
</tr>
<tr>
<td>Audi A7</td>
<td>$63,200</td>
</tr>
<tr>
<td>BMW 6-series (640i)</td>
<td>$66,950</td>
</tr>
<tr>
<td>Mercedes-Benz S-Class (S550)</td>
<td>$78,325</td>
</tr>
</tbody>
</table>

Source: Compiled by author using online search engine.
As mentioned earlier, powertrain sales to Daimler and Toyota served as an important additional source of revenue in the past. These sales are not excluded from automotive gross margin calculations\textsuperscript{12}. In contrast, development services for Daimler and Toyota (completed in 2014) and sales of regulatory credits to other automakers (ZEV and GHG credits), which had and continue to have a significant impact on Tesla’s gross margin, are excluded. These sources of revenue are not sustainable and do not qualify as part of Tesla’s core business.

**Cost of automotive revenues**

In the previous section, I discussed the possibility of raising prices for Tesla cars. The alternative way of solving the profitability problem is decreasing the cost to manufacture those cars. In their quest to accelerate the adoption of electric vehicles, Tesla executives

\textsuperscript{12} Tesla did not provide costs of powertrain sales in its SEC filings. Therefore, it is impossible to separate powertrain sales from automotive revenue.
often referred to technological improvements and economies of scale as the main factors driving down the total manufacturing cost of electric vehicles. In this section, I determine whether or not Tesla has been able to transform these theoretical gains into actual cost reductions during the last several years.

Given that detailed cost information is usually part of the business secret of any company, gross margin comparison is the only reliable method to assess the overall efficiency of Tesla’s operations. Figure 4 compares the overall gross margin of Tesla with the automotive gross margins of the three industry leaders: Toyota, Daimler and General Motors. Even though the electric carmaker managed to achieve the highest overall gross margin in six out of last seven years, Tesla’s executives cannot get too optimistic about the company’s performance. Because of a more expensive business model, Tesla’s advantage over the nearest competitor must be significantly larger. In addition, in order to determine the gross margin of the automotive segment, sales of regulatory credits, energy generation and storage products, and services and other must

Figure 4

Source: Annual reports of Tesla, Toyota, Daimler, and General Motors; compiled by author.
be excluded from the calculations. As a result, *Figure 5* offers a slightly more realistic view of the company’s operations. For example, it shows that in aggregate Tesla has been making little to no money on sales of cars up until 2013. This fact reinforces my earlier point about setting higher base prices for the Roadster and the Model S – this would have further implications such as higher investor confidence or better contracts with suppliers.

Another key takeaway from *Figure 5* is that the automotive gross margin has plateaued over the last three years. At the same time, the sales figures more than doubled. This a strong indicator that the production process has not been improving as quickly as Tesla’s public statements suggest. There are two possible explanations. The first one is related to the fixed contract with Panasonic to supply approximately 2 billion of 18650 Lithium-Ion battery cells from 2014 to 2017 (Kane, 2013). In other words, the battery cell technology has remained unchanged over the last several years. The second explanation is the negative impact of new product launches on production costs. For instance, the automotive gross margin was especially poor in 2008 and 2012 when the
Roadster and the Model S were launched. Elon Musk refers to this phenomenon as the production ramp S-curve. Nonetheless, economies of scale and technological advances are supposed to outweigh the inefficiencies associated with the production ramp of the Model 3. Undoubtedly, compared to the large auto manufacturers, Tesla has a lot of room for improvement in this key area of its business. In the following paragraphs, I isolate depreciation and amortization (D&A) and warranty expenses from the other costs and analyze these components of the cost of automotive revenues separately.

Depreciation and amortization expense has seen large increases during the ramp-ups in production of the Model S and Model X. In addition, it is increasing rapidly because of large capital expenditures associated with the construction of the Gigafactory 1. Interestingly, Tesla’s mix of property, plant, and equipment is significantly different from that of Toyota and Daimler (see Figure 6). A reasonable assumption to make would be that Tesla’s plant is more automated (i.e. using more equipment and less manual labor) than a typical plant of the other OEMs. However, I saw multiple reports from the industry experts who visited the Tesla Factory stating that they were shocked to see “so much manual labor on a line” (Campbell, 2017).
Alternatively, high D&A expense can be explained by the type of equipment Tesla utilizes. Elon Musk often boasts about the machine making other machines and its importance for the company. In other words, Tesla prefers to use large complex robots\textsuperscript{13} instead of several simple ones. Although I am not an expert, such machines might not only cost more, but also have a shorter estimated lifetime due to their complexity. In contrast, encouraged by the diffusion of the lean

\textsuperscript{13} The actual number of robots is unknown. This idea is taken from my Operations Management textbook called “Operations and Supply Chain Management: The Core” by F. Robert Jacobs and Richard B. Chase.
production system, the whole automotive industry has been going in the opposite direction since 1990s in order to match the efficiency levels of the Japanese factories. Regardless of whether Tesla’s robotic assembly line is too expensive or is depreciated too quickly, the fact is that the company’s depreciation and amortization expense is out of control. Figure 7 presents D&A expense as a percentage of total revenues. The inflection point coincides with the company’s decision to insource the battery operation by building the Gigafactory 1 near Reno, Nevada. The company plans to invest a total of $5 billion in this project through 2020. As of June 30, 2017, Tesla has incurred costs of $1.98 billion related to the construction of the Gigafactory (O’Reilly, 2017). Nonetheless, Figure 7

![The Nissan Factory, Sunderland, UK](image)

**D&A Expense, % of Revenue**

Source: Annual reports of Tesla, Toyota, and Daimler; compiled by author.
according to the company’s 2015 10-K annual report, Panasonic has agreed to invest in production equipment that it will use to manufacture and supply Tesla with battery cells. Although the electric carmaker still has to purchase equipment needed for assembly of battery packs, this partnership with Panasonic means that Tesla’s investments are depreciated on average over a longer period of time. Therefore, I assume that the robotic assembly lines and the factory retooling costs account for a significant part of the D&A expense. Compared to the industry leaders, Tesla spends 2-3 times more on depreciation and amortization per dollar of revenue. This implies either inefficient capital expenditures or inadequate asset utilization. Although rapid growth in the automotive industry requires substantial investments in capital, I regard D&A expense as a key cost component which Tesla needs to improve on in order to become a profit-making entity.

“Another significant difference between electric vehicles and gasoline-powered vehicles is the number of moving parts. The electric vehicle has one moving part, the motor, whereas the gasoline-powered vehicle has hundreds of moving parts. As a result, the electric vehicle requires less periodic maintenance and is more reliable. The gasoline-powered vehicle requires a wide range of maintenance, from frequent oil changes, filter replacements, periodic tune ups, and exhaust system repairs, to the less frequent component replacement, such as the water pump, fuel pump, alternator, etc.”

- Idaho National Laboratory, Advanced Vehicle Testing Activity

“A combustion engine has many shortcomings vis-à-vis an e-motor, which have to be dealt with through complex technical solutions. The only reason why electric cars have not become mainstream yet, is energy storage, i.e. the battery. The e-motor is superior to the ICE: less mechanical complexity and fewer moving / wearing parts, stronger and linear torque, shorter response time, no local emissions, wider usable rpm range, no "cold start" issues, no energy-consuming idle running and the capability of regenerative braking to recover kinetic energy. Additional components, such as a complex gearbox, a clutch, a starter generator, a start-stop system, and emissions after-treatment are required to address the shortcomings of the combustion engine.”

“Mechanical complexity is much lower, whereas electronic complexity is higher. We counted 24 moving parts in the Bolt's powertrain, versus 149 in the Golf.”

- The UBS research report
Some experts argue that electric vehicles require less maintenance than conventional vehicles, thus reducing maintenance costs. Are they right? To find out, I compare the warranty costs incurred by Tesla, Toyota, and General Motors. Figure 8 shows that, despite a large number of reliability issues associated with each new product launch, Tesla vehicles have consistently had lower warranty expenses than their gasoline-powered counterparts. Therefore, I conclude that electric vehicles indeed have small but clear advantage over conventional vehicles in terms of lower maintenance and repair costs. The warranty expense will be revisited later in the paper as one of the reasons for choosing and keeping the direct sales model.

Operating expenses

Operating expenses play an important role in the business of any car company. Most OEMs invest billions of dollars in research and development in order to develop new technologies, improve current vehicles and introduce new ones. Nowadays, having an extensive range of technologically-advanced vehicles is essential for being successful in
the highly-competitive automotive industry. Selling, general and administrative expenses, which include marketing costs, have a significant impact on the bottom line as well. OEMs strive to keep both R&D and SG&A expenses under control in order to reach their profitability targets. As this section will demonstrate, Tesla’s operating expenses are incommensurate to those of other auto manufacturers. The innovative business model and insufficient volume of sales are the main culprits.

According to an industry expert, an automobile manufacturer typically spends at least $1 billion\textsuperscript{14} and 4-5 years for development of a completely new vehicle (Shea, 2010). Clearly, Tesla managed to spend significantly less time and money on development of their vehicles. Figure 9 shows my estimates regarding the number of years spent on development of all Tesla vehicles. While Roadster and Model S estimates are reasonable, Model X and Model 3 estimates are rather conservative. It is worth noting that the beginning of the Model X production was delayed by more than a year because of the issues associated with the falcon-wing doors (allegedly caused by a certain supplier).

\textsuperscript{14} Development costs can reach as much as $6 billion for an all-new car on an all-new platform with no carry-overs from the previous model.
In general, being located in one of the most innovative places on the planet, Tesla has been very efficient in its research and development activities. *Figure 10* demonstrates the disparity in R&D expenses between Tesla and the industry leaders. Tesla’s ratio of R&D expenses is significantly higher, but, due to the reasons mentioned above, I attribute this mainly to lower revenues and the number of projects Tesla has undertaken in recent times. As revenues grow, the company needs to concentrate its research and development activities on the most important projects. Many experts question some of Tesla’s decisions as the company takes the design and manufacturing of routinely outsourced parts (e.g. seats) in-house. Finding the right balance between using internal resources versus purchasing or outsourcing is key. Although such an allocation is not obvious, the ultimate result is an improved profit margin as well as a better return on investments.

Tesla avoids traditional methods of advertising relying primarily on the word-of-mouth, certain social media platforms, and Elon Musk’s publicity. In addition, the

![R&D Expense, % of Revenue](image-url)
company receives plenty of media attention on a daily basis. Marketing costs incurred during the last six years are presented in Table 1. Although the company does not provide any useful information regarding its advertising and sales promotion activities, I deduce that increased marketing expenses from 2014 onwards are probably related to a number of promotional activities in the European Union and in Asia, where using traditional [or close to traditional] methods of advertising makes more sense. Accordingly, Tesla’s revenue growth (mostly caused by rapid international expansion) has largely offset increased marketing costs. Figure 11 demonstrates that Tesla has an advantage over its competitors who spend a larger portion of their total revenues on advertising and promotion, but the difference is not as large as I anticipated. Nonetheless, 

**Table 1**

<table>
<thead>
<tr>
<th>(dollars in ‘000s)</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marketing and sales promotion costs</td>
<td>$2,900</td>
<td>$3,900</td>
<td>$9,000</td>
<td>$48,900</td>
<td>$58,300</td>
<td>$48,000</td>
</tr>
</tbody>
</table>

Source: Tesla SEC filings.

**Figure 9**

![Marketing expenses, % of revenue](image)

Source: Annual reports of Tesla, Toyota, and General Motors; compiled by author.
because demand for Tesla vehicles is likely to exceed supply in the near future, it is reasonable to expect this difference to enlarge.

While I expect research and development expenses to decline as a percentage of revenues over time and get closer to the industry average, selling, general and administrative expenses are likely to remain disproportionately higher for Tesla because of its business model. Therefore, a direct comparison with other OEMs is meaningless. Unlike other automakers, Tesla owns and operates hundreds of galleries and showrooms in North America, Europe, and Asia. Additionally, the company has at least one service center in each major location. The process of establishing this support network is ongoing and is driving the costs up. However, provided that the first year of the Model 3 production is sold out, there is no need to open new stores until the company will be able to offer reasonable wait times for Model S, Model X and Model 3 deliveries. In Table 2, I compute the average SG&A expenses (including marketing) per vehicle sold by Tesla for the last six years. The results indicate that the efficiency of these expenses has not been improving since 2013. One explanation is the fact that Tesla has to constantly increase the number of service centers in order to support the growing fleet of Tesla vehicles on the roads around the globe. Another explanation is related to the company’s business development strategy. Despite inability to fulfill demand in the existing locations, the company continues to expand into less profitable locations where the cost of having a store and a service facility greatly exceeds the gross profit generated by additional sales. As a result, Tesla’s SG&A expenses almost cancel out the entire gross profit. Despite its focus on the overall growth, optimization of the selling, general and administrative

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<tbody>
<tr>
<td>SG&amp;A Expense per vehicle sold</td>
<td>$160,157</td>
<td>$50,974</td>
<td>$12,749</td>
<td>$18,864</td>
<td>$18,181</td>
<td>$18,872</td>
</tr>
<tr>
<td>SG&amp;A Expense as % of revenue</td>
<td>51%</td>
<td>36%</td>
<td>14%</td>
<td>19%</td>
<td>23%</td>
<td>20%</td>
</tr>
</tbody>
</table>

Source: Tesla SEC filings; compiled by author.
expenses must be one of the main objectives of the company. The costs of the direct sales model are high, but the benefits are also substantial and will be discussed in greater detail in Part II of this paper.

**Stock-based compensation and interest expenses**

“The very name says it all: “compensation.” If compensation isn’t an expense, what is it? And, if real and recurring expenses don’t belong in the calculation of earnings, where in the world do they belong?”

- Warren Buffet about Stock-Based Compensation, Berkshire Hathaway Inc. 2015 Shareholder Letter

I agree with Warren Buffet – stock-based compensation (SBC) is just another cost of doing business and must be treated in the same way as any other expense. In essence, SBC can and should be rephrased as an employee compensation paid by investors. I emphasize this issue because Tesla executives routinely exclude SBC from their non-GAAP calculations of earnings. However, doing so not only embellishes the reality, but also creates a false sense of satisfactory performance.

**Figure 10**

Source: Tesla SEC filings; compiled by author.
Looking at the financial statements of Toyota and GM and seeing negligent amounts expensed as a stock-based compensation, I suppose that large OEMs offer this type of compensation only to their senior-level executives. In contrast, Tesla grants stock options to employees at all levels of the organization. Moreover, the exercise prices are usually significantly below the current market prices meaning that Tesla employees can profit from their stock options immediately after receiving them. Being located in the Silicon Valley, one of the most competitive markets in the world, Tesla vies for talent with other automakers as well as with all the tech companies by offering lucrative compensation packages. Figure 12 shows that over the last three years the SBC expense has stabilized at approximately 5 percent of total revenues. Clearly, since profit margins are typically in mid- to high-single digits in the automotive industry, “spending” an additional 5 percent of revenues on the stock-based compensation is unsustainable in the long-run. Once again, Tesla puts its profit-generating capability [under GAAP] at a major disadvantage. In order to reduce the impact of this expense on the bottom line, the company needs to

Figure 11

Interest Expense, % of Revenue

Source: Annual reports of Tesla, Toyota, General Motors, and Daimler; compiled by author.
align employee interests with its own by granting “traditional” stock options (i.e. when the exercise price is equal to the current market price).

Similar to stock-based compensation, Tesla’s interest expense is predominantly non-cash. The non-cash portion is primarily related to amortization of debt issuance costs and losses on conversion of senior convertible notes. While the company’s cash flows stay intact, Figure 13 demonstrates that OEMs spend a significantly lower share of revenue on interest. And the picture is getting worse for Tesla in 2017. The trailing 12-month interest expense is $390 million – almost 4 percent of revenues – and is likely to increase by the year-end because of the recent $1.8 billion high yield bond issuance (Leong, 2017).

To summarize, the profitability analysis has demonstrated that Tesla’s operational results differ substantially from the industry standards. Most of these differences can be attributed to a completely different business model. Unlike a typical automaker, Tesla:

❖ operates its own strategically-located stores and service centers;
❖ facilitates vehicle refueling by building and operating the network of Supercharger stations around the globe;
❖ invests heavily in research and development;
❖ spends little to no money on traditional methods of advertising;
❖ utilizes a more capital-intensive production process; and
❖ issues a massive number of immediately-profitable stock options to its employees.

Excluding relatively insignificant marketing and warranty expenses, Tesla consistently spends more money on every other aspect of the automotive business than its competitors. Collectively, Tesla’s D&A, R&D, SG&A and SBC expenses devour approximately 50 percent of total revenues – compared to only 25 percent of revenues for the industry leaders. While these costs cannot be reduced radically overnight, cost optimization [or waste elimination] must be one of the major objectives of Tesla in the near term. The experience of the Japanese automakers has shown that lean enterprises can be more efficient in every aspect of the business. The company has shown a slow but consistent progress over time and the benefits of economies of scale are yet to be seen.
Tesla’s innovative business model is more expensive than a traditional one, but benefits are supposed to outweigh the costs in the long run.

2. Cash Flow Statement

While reaching profitability is a key objective for Tesla, Inc., consistently generating cash is important for becoming more self-sufficient and less dependent on the capital markets. Having said that, it is unlikely that Tesla will achieve a positive free cash flow\(^{15}\) in the near future. The company competes in a highly capital-intensive industry which means that substantial capital expenditures are necessary to support rapid growth. And, according to Elon Musk’s public announcements, Tesla does not intend to slow down. Therefore, the cash flows related to investing and financing activities are disregarded in this section. The main focus is the company’s ability to generate positive cash flows from its operating activities.

Operating cash flow (OCF) refers to the amount of cash generated by normal business operations. Higher OCF is always better; negative OCF is a red flag for many investors, including myself. As most startups do, Tesla has been burning cash at a fast rate during the first few years of existence. Nevertheless, the operational results have been improving steadily and in 2013 the company has not only reported the lowest year-end net loss, but also managed to generate more than $250 million in OCF. Both the company’s executives and the investing public have become extremely optimistic about the future. Unfortunately, the rate of improvement could not be sustained and things have been going south since then.

To assess the likelihood of Tesla getting back on the right track, I analyze the main factors affecting the company’s operating cash flows (besides profitability) and emphasize the most important issues to be concerned about. To begin with, Table 3

\(^{15}\) Free cash flow equals operating cash flow minus capital expenditures. Rapid growth in the highly capital-intensive automotive industry implies prolonged negative free cash flow.
presents the values of the activity ratios for Tesla over the last seven years. These ratios are the key financial measures used to evaluate a company’s performance pertaining to the management of inventory, accounts receivable and accounts payable. Days receivable ratio is insignificant because Tesla customers are billed immediately after their cars get delivered. In other words, Tesla’s accounts receivable are not related to the automotive business. Days payable ratio has a major impact on the company’s operating cash flow. For instance, a five-day increase in this ratio would be sufficient to achieve positive OCF.

Table 3

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<tr>
<td>Days Inventory</td>
<td>145</td>
<td>122</td>
<td>152</td>
<td>71</td>
<td>102</td>
<td>130</td>
<td>113</td>
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<tr>
<td>Competitors:</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Toyota</td>
<td>32</td>
<td>30</td>
<td>33</td>
<td>33</td>
<td>32</td>
<td>34</td>
<td>34</td>
</tr>
<tr>
<td>General Motors</td>
<td>36</td>
<td>39</td>
<td>40</td>
<td>40</td>
<td>37</td>
<td>40</td>
<td>37</td>
</tr>
<tr>
<td>Daimler</td>
<td>67</td>
<td>71</td>
<td>72</td>
<td>69</td>
<td>69</td>
<td>69</td>
<td>74</td>
</tr>
<tr>
<td>Other ratios:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Days Receivable</td>
<td>16</td>
<td>15</td>
<td>16</td>
<td>7</td>
<td>16</td>
<td>18</td>
<td>17</td>
</tr>
<tr>
<td>Days Payable</td>
<td>135</td>
<td>146</td>
<td>186</td>
<td>75</td>
<td>92</td>
<td>111</td>
<td>118</td>
</tr>
</tbody>
</table>

Source: Annual reports of Tesla, Toyota, General Motors, and Daimler; compiled by author.

in 2016. During the conference calls, Tesla executives often mention the improving terms of the contracts with certain suppliers. As a result, the company is able to postpone payments to those suppliers, thus decreasing its cash conversion cycle. It is worth noting that days payable ratio has almost reached its upper limit for Tesla, meaning that further benefits from increasing this ratio are improbable. Based on the data available, I conclude that Tesla manages its accounts receivable and accounts payable in an efficient manner. On the other hand, the company’s inventory management is significantly less efficient compared to other OEMs.

It is important to emphasize that Tesla’s direct sales model does not have a substantial impact on inventory. Tesla galleries and showrooms eliminate any extra inventory typically held by a traditional car dealership. Therefore, making a direct
comparison\textsuperscript{16} between Tesla and other automakers is appropriate in this case. Toyota and General Motors appear to be the industry leaders with Daimler lagging behind\textsuperscript{17}, but still doing much better than Tesla. Inventory management affects the operating cash flows both directly and indirectly. While the direct effect is obvious, the indirect effect is related to the costs associated with maintaining a certain level of inventory. These costs are mainly due to warehousing (rent, utilities, salaries), obsolescence (inventory write-downs), insurance, and opportunity (or cost of capital) costs. “The average cost of inventory in the United States is 30 to 35 percent of its value” (Jacobs – Chase, 2013). The actual cost of inventory for Tesla is uncertain – inventory write-downs usually constitute 3 percent of end of period inventory; based on multiple sources, the cost of capital is estimated to range from 8 to 10 percent; and other costs are unknown. In any case, the impact of cutting the days inventory ratio down to Daimler’s level is certain – Tesla is supposed to achieve higher operating cash flows and lesser operating expenses.

Although at this point in time Tesla is a relatively low-volume automobile manufacturer, savings from better inventory management will become more and more noticeable as the company continues to grow.

Table 4, which breaks down Tesla’s inventory into its component parts, helps identify the key areas for improvement. After making a series of assumptions\textsuperscript{18}, I estimate that Tesla had at least 6 weeks’ worth of raw materials inventory on hand at the end of 2016 – a very large amount compared to only a few days’ worth at a typical

\textsuperscript{16}I disregard the insignificant difference between Tesla and other OEMs associated with unavoidable finished goods inventory (service loaners, test-drive vehicles, and vehicles on display). Based on my estimates, it accounts for approximately 10 percent of total inventory.

\textsuperscript{17}Daimler’s high days inventory ratio is attributable to a surprisingly large amount of finished goods inventory. This could be caused by the fact that Daimler owns 98 company-operated “traditional” dealerships which account for about half of the company’s sales in Germany (Hetzner, 2013).

\textsuperscript{18}I assume that (1) the production output is approximately 2,000 vehicles per week, (2) raw materials account for 40 to 50 percent of the average selling price, and (3) a certain amount of raw materials is not related to the automotive business.
Table 4

<table>
<thead>
<tr>
<th>Inventory</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw materials</td>
<td>$163,637</td>
<td>$184,665</td>
<td>$392,292</td>
<td>$528,935</td>
<td>$680,339</td>
</tr>
<tr>
<td>Work in process</td>
<td>24,535</td>
<td>42,500</td>
<td>56,114</td>
<td>163,830</td>
<td>233,746</td>
</tr>
<tr>
<td>Finished goods</td>
<td>62,559</td>
<td>69,324</td>
<td>397,318</td>
<td>476,512</td>
<td>1,016,731</td>
</tr>
<tr>
<td>Service parts</td>
<td>17,773</td>
<td>43,866</td>
<td>107,951</td>
<td>108,561</td>
<td>136,638</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>$268,504</td>
<td>$340,355</td>
<td>$953,675</td>
<td>$1,277,838</td>
<td>$2,067,454</td>
</tr>
</tbody>
</table>

Source: Tesla SEC filings.

Toyota factory. While this problem can be explained in part by vertical integration, the difference between Tesla and other OEMs is quite large and cannot be attributed solely to the business model of the electric carmaker. According to multiple reports from various sources, Tesla is unable to reduce the amount of raw materials inventory because the company (1) often encounters production bottlenecks at its factories, (2) puts up with unfavorable supplier contracts, and (3) uses a conservative inventory management strategy in order to avoid production stoppages. The data indicates that the company has started addressing these problems in 2012. The amount of raw materials as a percentage of total inventory has been declining steadily since then and the trend continues in 2017. Nevertheless, further improvements are necessary to achieve a leaner production process. The goal is to develop close relationships with all suppliers, so that the cost of holding unnecessary inventory is not transferred from one party to another, but rather reduced significantly or eliminated altogether. Work in process (WIP) inventory is highly dependent on the current production volume. The main objective of the company is to make sure that future increases in WIP inventory are not caused by certain production bottlenecks, but rather by rising output. Finished goods (FG) accounted for almost 50 percent of total inventory in the end of 2016, but the percentage has been volatile over the last few years. The amount of FG inventory largely depends on the number of vehicles in
transit\textsuperscript{19}. Therefore, the problem of FG inventory will not be solved until Tesla builds at least one factory in each part of the world, thus reducing the average vehicle delivery time. Service parts inventory is correlated with the number of vehicles on the roads and is likely to increase in the nearest future. Tesla has to prepare for the upcoming launch of the Model 3 and ensure smooth operations of the service centers. To summarize, a more efficient inventory management for Tesla boils down to lower levels of raw materials inventory, elimination of bottlenecks in the manufacturing process, and faster delivery times for completed vehicles.

Changes in current assets and liabilities have a significant impact on the cash flows from operating activities, but operational results from the income statement are more influential. Tesla has been relatively successful in preserving cash – while the total accumulated deficit is almost $3 billion, the total cash used in operating activities in the last nine years is approximately $1.1 billion. These cash savings are mainly attributable to depreciation and amortization and stock-based compensation expenses. Since the beginning of the Gigafactory 1 construction, the company’s capital expenditures have been rising rapidly resulting in larger and larger D&A expense. Although the bottom line of the income statement is negatively affected by increasing D&A, OCF remains unchanged. SBC expense has a similar impact on Tesla’s performance. However, unlike D&A, it is not reflected in any other part of the cash flow statement. SBC is one of the methods (sales of regulatory credits, customer deposits, non-cash interest expense, etc.) used to artificially improve financial performance of Tesla. Having said that, I believe that Tesla can achieve positive OCF prior to becoming a profit-making entity.

Tesla keeps a lot of cash on hand in anticipation of massive capital expenditures required to [partially] complete the construction of the Gigafactory 1 and to acquire a new assembly line needed for the ramp-up in production of the Model 3. In addition to

\textsuperscript{19} For example, 2,750 vehicles “missed being counted as deliveries in Q4 either due to last-minute delays in transport or because the customer was unable to physically take delivery” and, additionally, 6,450 vehicles were in transit at the end of Q4 2016
the impending capital expenditures, the primary goal of Tesla is rapid growth – the company has to achieve economies of scale before the major automakers enter the electric vehicle market with competitive product offerings. Moreover, the recent acquisition of the SolarCity Corporation has put additional pressure on Tesla’s cash position. The solar energy company has lost $759 million on $246 millions of revenue and reported a negative operating cash flow of $426 million in nine months prior to the acquisition. The current cash burn rate – $8,000 dollars per minute – puts the company into jeopardy of becoming insolvent by the end of 2018 (Ahmed – Bakewell, 2017). Despite serious initial problems, Tesla is relieving the Model 3 production bottlenecks slowly but surely. Nonetheless, the contribution margin of the Model 3 is unlikely to offset the capital expenditures in 2018. Accordingly, Tesla is likely to need multiple rounds of financing in the near term.

**Part II: Key Value Drivers**

The first part of the paper has demonstrated that the cost structure of Tesla is inferior to other OEMs. In almost every aspect of its business, the company incurs higher expenses than major competitors. Yet, the current market capitalization of Tesla, Inc. is approximately $57 billion – $7 billion ahead of the Ford Motor Company and only $2 billion behind the General Motors Company. In this part, I will identify and elaborate on the key drivers of Tesla’s high market valuation. Apparently, the value of Tesla does not lie in the company’s operational efficiency, but rather hinges on several less tangible factors such as a superior business model, an untarnished brand image, first-mover advantages in the electric vehicle segment, and the vision of Elon Musk.

3. **Sustainable Competitive Advantages**

*Direct sales model*

The decision to bypass the dealerships and sell cars directly to customers constitutes a major difference between Tesla and other OEMs. While some investors are [indirectly]
betting on superiority of the direct sales model, others are waiting impatiently to see whether or not Tesla will prove it successful.

Although this model increases the cost of doing business by a large amount, there are reasons to believe that it provides Tesla with a sustainable competitive advantage. To begin with, the cost of the direct sales model can be compared with the cost of selling cars through the dealerships. One method is to find out the average difference between MSRP and price charged by OEMs. According to the UBS report, a typical dealer margin is 15 percent of MSRP\(^{20}\). Going back to Table 2, Tesla’s SG&A expense is roughly 20 percent of total revenues. Toyota and General Motors spend less than 7 percent of revenues on SG&A expense, and Daimler – a more comparable OEM to Tesla – spends 10 percent. Simple math suggests that going with the traditional dealership model would lead to significantly higher losses for Tesla during the last three years of operations unless the company could raise the customer-level prices by at least 5 percent and sell the same quantity of cars. In essence, the cost of Tesla’s innovative business model is lower even at the current level of sales volume.

Another method to compare costs is to look at the potential savings in the vehicle order-to-delivery cycle from build-to-order, direct manufacturer sales. According to a 2000 report by a Goldman Sachs analyst, the total cost savings based on an average vehicle price of $26,000 were estimated as $2,225 or about 8.6 percent\(^{21}\). The only real-world proof of these estimates is GM do Brazil’s experience with production and sale of

\(^{20}\) Given that Tesla sells luxury cars, this is a conservative estimate. Dealer margin consists of dealer mark-up, dealer holdback, and factory to dealer incentives (customer rebates, cash back, and other special programs).

\(^{21}\) The components of those savings were as follows: $832 from improvement in matching supply with customer demand; $575 from lower inventory; $387 from fewer dealerships; $381 from lower sales commissions; and $50 from lower overall shipping costs, since fewer dealerships would reduce the number of distribution points. The Goldman Sachs report identified other possible build-to-order savings of about $1,000 per vehicle in product development, manufacturing flexibility and procurement and supply.
Chevrolet Celta in 2000s. By selling cars over the internet, GM enjoyed a competitive advantage from reduced production time, lower inventory levels and a more efficient distribution model, whereas the customers took advantage of about 6 percent decrease in prices (Bodisch, 2009). In case of Tesla, cost savings can come from multiple sources. First, the company’s low marketing expense can be partially attributed to the direct sales model. Tesla galleries and showrooms are always located in areas with high foot traffic (e.g. large shopping malls or downtowns of major cities), thus creating an efficient combination of selling and advertising. Second, Tesla is able to better control costs of inventory. Unlike conventional dealerships, Tesla stores and galleries do not carry any excessive inventory because the vast majority of vehicles are built-to-order. Third, the company saves on labor costs by not paying commissions to its sales personnel. Because Tesla-employed salespeople are considered to be working in retail, their hourly wages are close to the minimum and the total compensation is not linked to the number of cars sold. Lastly, the profit margin required by a third party is retained by the automaker. While other sources of savings are possible, these four yield the highest benefit for Tesla and are likely to become even more pronounced when the volume of sales rises.

In addition to being more cost efficient, the direct sales model provides the company with certain non-financial benefits which have an impact on the bottom line, but are not easily quantifiable. One of them refers to Tesla’s full control over customer experience and satisfaction. Because Tesla-employed salespeople are not incentivized to push sales, their main objective is raising customer awareness about the brand and electric cars in general. Another important benefit is rapid customer feedback. Being a small automobile manufacturer with limited experience, the company needs feedback to rationalize the process of addressing and solving inevitable quality and reliability issues associated with the new products. The ultimate goal of Tesla is to “create a differentiated buying experience from the buying experience consumers have with franchised automobile dealers and service centers”.

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In theory, the direct sales model has a potential to benefit the buyer as well as the seller. The diagram below lists the key advantages of this model for both parties. While the manufacturer’s advantages are evident, the customer’s advantages have to be discussed in greater detail. First of all, lower distribution costs are [partially] passed on to the customer. Although Tesla does not offer discounts, I explained above that the direct sales model enables the company to set lower MSRP's. Second, many individuals report in surveys that they would prefer to deal directly with the manufacturer. Perception of lower prices, ability to provide feedback, and negative connotations associated with conventional dealerships are some of the possible reasons. Last but not least, the buying process is more convenient and less stressful for Tesla customers. The prices are non-negotiable meaning that the prospects do not have to be concerned about getting a “bad deal”. All activities related to the purchase of a new car – learning about the company and the cars, evaluating pros and cons of owning an electric vehicle, having a test drive, and placing an order online – are conducted in a stress-free environment. Generally speaking, all these benefits make a case in favor of Tesla, even though they are often based on personal preferences and may not be important for every customer. The following quotes reinforce some of my arguments:
“The dealers have almost no link with the sales and marketing divisions, which are responsible for moving the metal. The dealer’s skills lie in persuasion and negotiation, not in feeding back information to the product planners. Moreover, a dealer has little incentive to share any information on customers with the manufacturer. The dealer’s attitude is, what happens in my showroom is my business.”

“The bazaar tradition of car selling – where the customer and the dealer try to outwit each other on price – is still firmly in place at dealerships, even though more and more buyers report in surveys that they thoroughly dislike it.”

- About customer feedback and buying/selling process in the traditional dealership system, “The Machine that Changed the World” by James P. Womack, Daniel T. Jones, and Daniel Roos

“Surveys show that many new car buyers in America would be interested in buying directly from manufacturers, particularly to avoid costs associated with the dealer/customer bargaining process. In one survey, almost half of respondents said that they would opt to buy cars direct from the manufacturer even if it did not save any money.”

- Gerald R. Bordisch, Economic Effects of State Bans on Direct Manufacturer Sales to Car Buyers

Tesla is the only automaker to take advantage of the direct sales model. Without doubt, this model can be extremely beneficial for the OEMs, yet devastating for the dealers. Therefore, many states protect them by restricting the ability of OEMs to engage in selling cars directly to customers. In this case, how did Tesla get permission to do that? The official reason is that state laws do not apply to Tesla because the company’s internet sales occur across state lines. However, in my opinion, the actual reason includes another important factor – the dealers. My research indicates that neither Tesla, nor dealers should be interested in partnering with each other.

I believe that the business models of Tesla and a typical dealer are incompatible. One of the main reasons is the fact that Tesla sells electric vehicles which require far less

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22 Excluding Texas, Connecticut, Michigan, Louisiana, Utah, and West Virginia where the government makes it illegal to walk into a Tesla store and buy a car (Garcia, 2017). Despite these restrictions, the company is still allowed to have showrooms and customers are forced to take delivery of their vehicles in adjacent states.
maintenance than conventional vehicles. The third row of Table 5 demonstrates that the network of service stations has always been growing at a slower rate than the fleet of Tesla cars on the roads. Along with the experts’ opinions and the analysis of the company’s warranty expense, this is yet another proof that electric vehicles do not break as often as conventional vehicles. The research analysts from UBS estimate that the aftermarket revenue pool will drop by approximately 60 percent in an EV only world. While Tesla does not make any profit off of post-purchase sales and services, traditional dealerships rely heavily on them. According to the latest National Automobile Dealers Association (NADA) annual report, the service and parts department of an average light-vehicle dealership makes up only 12 percent of total revenues, but accounts for a hefty 45 percent share of gross profit. This share goes up to 59 percent for an average luxury dealership (see Exhibits 3a – 3d). In addition, the used-vehicle department is not a significant source of revenue [and gross profit] for Tesla. Both departments are vital parts of a dealer’s business model needed to cover SG&A expenses such as rent and

Table 5

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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of stores, galleries, Service Plus* and service facilities</td>
<td>16</td>
<td>20</td>
<td>32</td>
<td>116</td>
<td>159</td>
<td>208</td>
<td>260</td>
</tr>
<tr>
<td>Number of service locations (including Service Plus*)</td>
<td>29</td>
<td>70</td>
<td>95</td>
<td>118</td>
<td>135</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of vehicles per service location</td>
<td>176</td>
<td>393</td>
<td>626</td>
<td>934</td>
<td>1379</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Introduced in 2013, Service Plus is a combination of a service center and a store

Source: Tesla SEC filings; compiled by author.

23 Because the typical margins on sales of new vehicles are low, dealers are incentivized to set higher than necessary prices for parts and services. On the contrary, Tesla has no incentive to charge higher prices. The reason is that the vast majority of Tesla vehicles are still under the manufacturer’s warranty meaning that the company covers most of the maintenance and repair costs. Moreover, in order to prove the point that electric vehicles require little to no maintenance, Tesla executives have made a pledge to never strive to profit from selling parts and services.
advertising\textsuperscript{24}. Based on these facts, I infer that hypothetical Tesla dealerships would require heavy discounting (25-30 percent of MSRP\textedsymbol)s from the electric car manufacturer to be profitable.

Another important point is that Tesla is an innovative, risky and inexpert startup company. None of these adjectives match well with conservative car dealerships. In the beginning, despite very low quantity of cars sold, the company still opened a considerable number of stores all over the world in order to increase product and brand awareness. I seriously doubt that a franchised dealer would be willing to invest in growing the network of stores and service centers of a company with a single product and a high probability of failure. At the same time, I cannot imagine dealerships adopting the Tesla’s approach to distribution, where they lack any expertise.

The final point refers to the brand image of the electric automaker. Elon Musk and other executives refer to Tesla as “the world’s only fully integrated sustainable energy company”. They firmly believe that any association with a dealer selling gasoline-powered vehicles of other automakers would tarnish the brand image of Tesla. Since dealers of electric vehicles only do not exist yet, I am certain that no dealer would be interested in becoming an exclusive dealer of Tesla vehicles, mainly due to the risky nature of such an endeavor. In essence, I can conclude that a partnership between Tesla and a franchised dealer, no matter how different or modified, would hurt the bottom line of both parties involved.

Initially, I was alarmed by the high cost of the direct sales model, but this analysis defends Tesla’s choice of the distribution model. Although SG&A expenses is not the primary cause of Tesla’s losses, the company needs to optimize these costs in order to

\textsuperscript{24} In January 2016, the Federal Trade Commission held the Auto Regulation Workshop in Washington, D.C. During a panel discussion titled “Auto Distribution: Current Issues & Future Trends”, Todd Maron, the general counsel at Tesla, Inc., pointed out that “manufacturers typically fund dealer advertising, but Tesla does not advertise”. He concluded that no franchised dealer would accept not being able to advertise.
leverage all of its benefits to a full extent. An inability to do so in the near future (starting with the Model 3 rollout) may prevent the company from generating profit any time soon.

*Exclusive access to the network of Tesla Superchargers*

Historically, automobile manufacturers refrained from owning gas stations. In the same way, they do not plan to develop their own network of refueling stations for electric vehicles. Instead, their electric vehicle programs rely on third-party providers of charging infrastructure such as ChargePoint, EVgo, Blink, AeroVironment, and other. These companies focus mainly on building AC Level 2 charging stations (10-20 miles of range per hour of charging). To address this problem, large automakers partner with them to increase the number of DC Level 3 fast-charging stations (at least 60-80 miles of range per 20 minutes of charging) in the United States. For example, BMW and Nissan have recently partnered with EVgo (Silvestri, 2017). Nevertheless, Tesla decided to integrate vertically by investing in its own network of charging stations.

In 2012, in conjunction with the ramp in production of the Model S, Tesla introduced and started building a network of Supercharger stations – DC fast-chargers capable of filling up 80 percent of the battery within 40 minutes of charging. The main purpose of this network is to facilitate long-distance travelling for Tesla owners at no additional cost. Currently, despite a large number of independent networks of charging stations, Tesla owns the largest network of DC Level 3 stations and, as Table 6 indicates, the number of stations around the world is constantly growing. In my opinion, this is an excellent marketing tool which not only differentiates Tesla from competition, but also gets rid of one of the major disadvantages of owning an electric car and lures in more skeptical customers.

<table>
<thead>
<tr>
<th>Table 6</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Supercharger stations</td>
<td>10</td>
<td>90</td>
<td>380</td>
<td>548</td>
<td>790</td>
</tr>
<tr>
<td>Number of vehicles per station</td>
<td>510</td>
<td>306</td>
<td>157</td>
<td>201</td>
<td>236</td>
</tr>
</tbody>
</table>

Source: Tesla SEC filings; compiled by author.
Based on data collected by the Alternative Fuels Data Center of the U.S. Department of Energy, the total number of public electric charging outlets in the United States as of November 23, 2017 is 45,245 (on average, 2-3 outlets per station). Only 5,931 of them are DC Level 3 outlets, including 2,519 Superchargers which are for Tesla use only. At the same time, all other public EV charging outlets are available to Tesla owners as well as to the owners of other plug-in vehicles.

Tesla plans to continuously expand the network of Superchargers and destination chargers\(^\text{25}\) to support its growing fleet of vehicles. UBS research analysts estimate that the cost of building a fast charger (one DC Level 3 outlet) is approximately $35,000 and the cost of a parking/garage charger (one AC Level 2 outlet) ranges from $2,500 to $3,000. These numbers indicate that the cost of building and operating Superchargers is insignificant for Tesla. In any case, the cost of providing an access to the Supercharger network is included in the price of a vehicle and the revenue is recognized by the company over time. Therefore, I assume that the cost of expanding the network is largely offset by this additional revenue stream.

Without doubt, 40 minutes it takes to charge an empty battery is a lot of time. Tesla tried to solve the charging problem by introducing a battery swap technology in 2013. The company opened the pilot battery swap station which was capable of replacing an empty battery with a fully-charged one in a matter of minutes. However, swapping batteries was not a viable option and the company closed the pilot station two years after the opening (Fortuna, 2016). There are indications\(^\text{26}\) in the market that pursuing a faster

\(^{25}\) The company works with a wide variety of hospitality locations, including hotels, resorts and shopping centers, to offer an additional (Level 2) charging option for Tesla customers. I do not draw attention to this part of Tesla’s network of charging stations. As of December 31, 2016, over 4,140 locations around the world had more than 7,110 Tesla wall connectors installed.

\(^{26}\) Daimler decided to acquire StoreDot Ltd. – an Israeli battery startup seeking to commercialize technology that can charge electric vehicles in just minutes. In addition, ChargePoint has recently introduced a new 400 kW DC fast-charging technology (vs. 145 kW power output of the latest version of Tesla Supercharger).
charging technology must be a better option for Tesla. Superchargers will not remain superior to other charging stations for a very long time. The good news is that the company is addressing this issue. In his Twitter messages, Elon Musk has been alluding at significantly higher charging speeds for the next-generation Supercharger and, at last, the new Megacharger has been introduced during the Tesla Semi unveil event.

The fact that Tesla is not only expanding the network of Superchargers and destination chargers, but also improving the technology is encouraging. Ideally, Tesla should be able to facilitate near-instant charging at its public charging stations. With regard to network expansion, the company must focus on increasing the number of ultra-fast chargers in Europe and China. Unlike in the United States, the proportion of people living in detached houses is significantly lower in those regions (33.3 percent in the EU vs. 57.8 percent in the U.S.). Therefore, in order to make Tesla vehicles more appealing for wealthy apartment dwellers, the company has to provide them with an unlimited access to an extensive network of ultra-fast public charging stations located in the cities. I see this as a key criterion for sustaining strong demand for the Model 3 beyond 2019 when the company is scheduled to fulfill all the reservations.

**Efficient product development**

Based on the financial statements and the general strategy of Tesla, I conclude that the company has been and will continue spending its research and development dollars more efficiently than other OEMs. Going back to the Roadster, I estimate that the company spent less than $150 million on the development of its first production vehicle. As a point of comparison, General Motors invested approximately $350 million in the unsuccessful EV-1 program in early 1990s (Shnayerson, 1996). By the end of 2015, Tesla spent a total of $2.2 billion on R&D. In addition to the development costs of three new models, this number includes R&D expenses related to autonomous driving, fast-charging, and battery and electric powertrain technologies, all of which can and will be used in subsequent models.
Another important consideration is that Tesla does not plan to offer a wide range of products in the future. In doing so, the company not only avoids unnecessary investments in research and development, but also reduces the importance of sales cannibalization (which is a major problem for other OEMs due to their extensive product lines). Each model serves a separate market segment and no alternative exists. Essentially, Tesla mimics Apple’s strategy which works well in the consumer electronics industry. Customers do not always know exactly what their needs are, and offering several “different” versions of the same product will not necessarily make their choice easier. Moreover, Elon Musk believes that a car can become a commodity in the near future, similar to what smartphones and laptops have become nowadays.

As mentioned above, large auto manufacturers tend to spend billions of dollars on redesigning their existing models and developing new ones. In some cases, these companies have to design and develop a new powertrain – a very expensive and lengthy process. In contrast, Tesla does not have to reinvent the battery or the electric motor for each specific model and can concentrate its R&D activities on either gradually improving the existing technology, or actively looking for a major breakthrough. Unlike different gasoline-powered vehicles, electric cars can use the same battery and electric powertrain technologies and the only differential is the size of the battery pack. For example, Model S and Model X share the same powertrain when the battery size is identical. Talking about electric vehicle development, other OEMs do not plan to scale back their investments: Volkswagen has recently announced $10 billion investment in electric vehicles over the next five years (Higgins, 2017); Ford aims to add 13 electrified models over the next several years, with a five-year investment plan of $4.5 billion; and GM plans to have 20 all-electric models by 2023, without specifying necessary investments (Vlasic – Boudette, 2017). While $2.2 billion is a lot of money for Tesla, its R&D spending is nowhere near what the big car companies spend. Currently, Tesla is a market leader in terms of electric vehicle development. This gives the company an important
competitive edge. Basically, Tesla overcomes one of the major barriers to entry into the automotive industry – the high cost of new product development.

**Brand image**

Tesla managed to build a very strong brand in a relatively short period of time. Although many carmakers are entering the electric vehicle market, none of them is capable of matching the brand image of Tesla. As mentioned earlier, Tesla has become the world’s only fully-integrated sustainable energy company after acquiring the SolarCity Corporation.

The mission statements of the other OEMs are mainly focused on beating the competition and doing so profitably. On the other hand, as I discussed in the Introduction, the mission of Tesla emphasizes the company’s goal of reducing the impact of human activities on the environment. Because of an appealing mission, Tesla is able to position itself as the main protagonist in the auto industry. However, most people overstate the importance of using electric vehicles instead of conventional vehicles. According to the Environmental Protection Agency, transportation is responsible for slightly less than a third of CO₂ emissions in the United States and the share of light-duty vehicles is approximately 19 percent (*Global Greenhouse Gas Emissions Data 2017*). Taking into account the fact that very few people will actually install solar panels or solar roofs, replacing conventional vehicles with electric vehicles is only the first step towards a more sustainable future.

Without doubt, the “greenness” of the electric carmaker plays an important role, but there are numerous other aspects of the company and its products that strengthen the Tesla brand. In my opinion, design of each Tesla car is what stands out for most customers. Unlike other electric vehicles currently on the market, these cars look even better than the vast majority of gasoline-powered counterparts (see Exhibits 4a – 4f). Franz van Holzhausen, chief designer at Tesla, Inc. and a former director of design at Mazda North American Operations, is responsible for all of them, except for the first-generation Roadster. It is worth noting that his designs are not only attractive, but also are
incredibly efficient pertaining to the drag coefficients\textsuperscript{27} of Tesla cars. Other important brand-building aspects include extraordinary vehicle performance, continuous technological advancement, and relentless focus on improving vehicle safety. With regard to certain areas of electric vehicles where Tesla is currently ahead of competition, other carmakers are likely to close these gaps in the near future.

4. First-Mover Advantages

Tesla was one of the first automakers to place a serious bet on electric vehicles and the first one to win it. The company’s first-mover status is one of the reasons Tesla has been able to create a strong brand image and capture almost the entire high-end electric vehicle market. However, in light of recent announcements made by other OEMs, Tesla will have a hard time trying to remain at the forefront of technological advancement.

Electric powertrain technology

Currently, Tesla occupies a leading position in terms of electric powertrain technology – the best performance among electric vehicles and the highest range because of the most efficient batteries. However, the company’s major competitors have not started investing heavily in the development of their own technology. Large automakers prefer to play this game conservatively by relying mainly on suppliers. For example, LG Group alone supplies 56 percent of Chevy Bolt’s content. Although the company will face nothing but tough competition in the future, it is possible for Tesla to maintain its competitive advantage and stay at the forefront of the electric powertrain technology. One way to do that is to make wise acquisitions. For example, a small Austrian startup named Kreisel is making good progress in Li-Ion battery technology. Their batteries are already considerably lighter (in kg per kWh) than Tesla’s, but costs are not publicized. Several large automakers such as Daimler and General Motors prefer to make small

\textsuperscript{27} Low drag coefficient (Cd) can increase the range of electric vehicles dramatically. For example, Tesla asserts that reducing $Cd$ of the Model S from 0.32 to 0.24 added 50 miles to the range of the vehicle. The original Roadster had a 0.36 $Cd$, the Model X – 0.24 $Cd$, and the Model 3 – 0.23 $Cd$. 
investments in tech startups, rather than spend billions on R&D. Accordingly, I believe that future innovations by both suppliers and OEMs will level off the playing field in a few years’ time. While the powertrain technology is still somewhat better, Tesla’s Autopilot seems to be already behind competition.

*Autonomous driving technology*

Tesla was one of the first auto manufacturers to develop and commercialize certain features of autonomous driving such as adaptive cruise control, lane departure warning, lane keeping, and self-parking. Since the very beginning, the goal of the Tesla Autopilot program was to achieve full self-driving capability. The company has recently introduced the Enhanced Autopilot which enables a Tesla to automatically change lanes without requiring driver input, transition from one freeway to another, exit the freeway when the destination is near, and be summoned to and from the garage. However, many drivers reported serious issues associated with the new capabilities of the Autopilot. For that reason, the company had to slow down and spend some time solving those issues. To tell the truth, Tesla’s first-mover advantage in this area has been dwindling since late 2016 when the development of the Autopilot technology was taken completely in-house. Although the Californian automaker is clearly ahead of other OEMs, the [potential] third-party providers of the technology such as Uber Technologies or Google’s Waymo are currently leading in a race towards fully autonomous driving.

In addition to billions of miles driven in simulation, the fleet of Waymo vehicles has already self-driven more than 3 million miles, mostly on city streets. Based on the “disengagement reports” from the California DMV, Waymo self-drove 636,000 miles with only 124 human interventions, a 19 percent drop from the previous year, during the period from December 2015 to November 2016 (Davies, 2017). Unlike Google’s autonomous driving program, Tesla did not log thousands of self-driven miles. Tesla opted for a completely different route – as illustrated in the picture below, the company gathers large amounts of data from the fleet of Tesla vehicles driven by the customers. In addition, the two companies rely on rather different sets of hardware to make cars drive
themselves (Hanley, 2017). While Waymo installs LIDAR (Light Detection and Ranging) sensors on its vehicles, Tesla uses RADAR (Radio Detection and Ranging) sensors which are significantly cheaper28. The two types of sensors differ in the level of accuracy of the images they produce. The question is whether one approach is better than another. Given Google’s resources and the fact that the tech giant has already managed to cut LIDAR costs by 90 percent, I expect Waymo to be the first company to get regulatory approval for its self-driving technology.

Source: https://twitter.com/mitchturck/status/798226178037268480

28 Due to continuous innovation in this field and unknown number of sensors installed, the actual costs of the different sensors are uncertain.
Despite Waymo’s progress towards fully autonomous driving, suddenly dropping the Autopilot program and partnering with Google is not a viable option for Tesla. The decision to develop self-driving technology has been made a number of years ago and the company cannot afford to back down at this point. This is not about the sunk costs of developing the existing technology, but rather about keeping the promise to continuously improve Autopilot’s capabilities. The company installs necessary hardware on every vehicle manufactured and thousands of people have already purchased some version of the software. Ending the Autopilot program would madden both the customers and the investors. I consider the company’s push into autonomous driving technology to be one of the primary reasons for its high market valuation. Should the Autopilot program prove unsuccessful, and we are talking about billions of dollars of lost market value.

5. The Vision of Elon Musk

The value of Tesla is partially determined by Elon Musk’s vision of the future of the company and the automotive industry. While some of his ideas are total failures (e.g. the 90-second battery swap technology), others may prove successful (e.g. the fleet of fully autonomous taxis).

The CEO of Tesla recognizes the issues faced by the Millennials. To address one of them – inability to afford owning expensive assets such as cars – he plans to accelerate the rise of a sharing economy. Once the fully autonomous driving technology is approved by the regulators, Tesla drivers will be allowed to share their vehicles with others and earn money doing that. Creating a fleet of autonomous taxis is a sound idea from both economic and emissions standpoints. The average utilization rate of automobiles in the U.S. is only about 5 percent (Neil, 2015). In addition, even though electric vehicles are emissions-free, their production is not. Hence, it makes sense to induce some individuals to rent cars when needed and avoid buying an asset which would barely be used. This idea can potentially become a game changer. However, in order to expand into the car rental business, Tesla has to develop a self-driving technology, prove its safety to the regulators, and make renting a car as simple and inexpensive as using a personal vehicle.
Another reason to admire Elon Musk is his relentless pursuit of perfection. He truly wants to build the best electric car possible (Sage, 2017). For instance, his thorough approach towards designing a car caused prolonged production delays related to the Roadster and the Model X. The cost of reaching perfection is of secondary importance for Musk. If suppliers of a certain part or component do not live up to expectations, Tesla will take the design and manufacturing of it in-house (e.g. seats). Without doubt, Musk’s approach hurts Tesla’s profitability, but improves the ultimate product offering, enhances the brand image, and creates a loyal customer base.

So far, this paper focused mainly on the internal weaknesses and strengths of the electric carmaker. The financial analysis revealed serious inefficiencies associated with the production system and the general business strategy of Tesla. Despite these issues, Tesla managed to achieve incredible success over the last several years. Essentially, by addressing the major concerns of the public pertaining to EVs (see Exhibit 5), Tesla has been able to create and sustain a strong demand for its vehicles over time. Accordingly, the initial success of the company has led many investors to start believing in the electric future of the automotive industry. On the assumption that the current issues will be taken care of, I believe that Tesla has a decent chance to be an important part of that future.

**Part III: Upcoming Challenges and Long-Term Prospects**

In this part, I analyze some of the major challenges that lie ahead of the company in the near and medium term. These challenges can be separated into two categories: those that have a direct impact on the financial performance of Tesla and those that have an indirect impact on the bottom line. Regardless of the nature of a specific impending problem, every one of them has to be taken into account when evaluating the long-term prospects of Tesla in the highly competitive automotive industry.
6. Financial Challenges

Unionization

The Tesla Factory in Fremont, California currently employs more than 10,000 workers. As the only U.S.-based automaker without a union-represented workforce, Tesla has been on the United Auto Workers (UAW) union’s radar for some time. So far, the company has been able to take advantage of nonunionized labor. However, I expect this fortunate for Tesla situation to change soon.

On August 31, 2017, the National Labor Relations Board consolidated the complaints of three former Tesla employees as well as a complaint made by UAW and filed a complaint against Tesla, “alleging that the company had discouraged workers from distributing pro-union information, stopped them from talking about employee safety to the UAW union, and in one case, prevented an employee from taking a picture of the Confidentiality Agreement they had to sign” (Geuss, 2017). Despite Tesla calling the complaint “entirely without merit”, there are plenty of other negative reports indicating that the UAW has a valid reason to unionize the workforce at the Tesla Factory. These reports are mostly related to worker safety and general workplace conditions. Moreover, hourly pay at the plant ranges between $17 and $21 in most cases – well below a national average of $25.58 for auto workers – and does not cover the cost of living in Alameda County where the factory is located (Ohnsman, 2017). Although the company makes an effort to suppress unionization efforts at its Fremont manufacturing plant, Tesla is no longer a startup and unionization is a looming [and probably inevitable] threat to the automaker’s cost structure.

UAW would use its power to bargain higher cash salaries and more additional benefits for the factory workers. Data indicates (see Exhibit 6) that unionized labor is significantly more expensive than nonunionized labor. The total cost to the employer of a unionized workforce, including cash wages and noncash benefits, is typically $10 per hour worked higher. The difference becomes even larger in the production occupational group (Long, 2013). Current wages at the Tesla Factory are at least $5 per hour below the
national average and almost $10 below the minimum living wage in the area. Taking into account the number of employees employed at the Tesla Factory, I estimate that yearly labor cost savings are at least $200 million, assuming 40-hour average work week. Having said that, the company has to invest in gradual improvement of workplace conditions in order to create positive publicity. I consider this as one of the ways to postpone unionization until better, more stable times. It is worth noting that Tesla operates two other large facilities, Gigafactory 1 and Gigafactory 2, and plans to employ thousands of workers at each of those factories, making them ideal targets for the unions.

**Absence of governmental subsidies/incentives**

Tesla has always enjoyed strong demand in countries with strong governmental support of electric vehicles, but experienced significant declines in sales when subsidies/incentives were taken away (e.g. Denmark). The electric vehicle manufacturer will face the same issue in the United States in 2018 when the tax incentives for customers begin phasing out. While subsidies at the customer level are likely to decline or disappear in most countries and put a downward pressure on demand for Tesla vehicles, the company will be able to continue selling zero emission vehicle (ZEV) credits\(^\text{29}\) to other automakers in the near term. Currently, Tesla benefits greatly from the ZEV regulation and generates hundreds of millions of additional revenues by selling ZEV credits at little to no additional cost. However, I expect this source of revenue to diminish over time as more and more automakers introduce their own zero emission vehicles.

China announced a similar program several years ago, called the New Energy Vehicle (NEV) program. Starting in 2019, large automakers will be required to earn or

\(^{29}\) The ZEV Regulation in California requires large volume and intermediate volume vehicle manufacturers to sell a certain percent of zero-emission vehicles (such as battery electric and fuel cell vehicles), clean plug-in hybrids, clean hybrids and/or clean gasoline vehicles with near-zero tail pipe emissions. Different types of clean vehicles earn different amount of ZEV credits. These credits can be transferred between the manufacturers. Besides California, nine other states adopted the ZEV Regulation in the last few years (Connecticut, Maine, Maryland, Massachusetts, New Jersey, New York, Oregon, Rhode Island, and Vermont).
purchase electric vehicle credits for 10 percent of total sales that year, increasing to 12 percent by 2020 (Perkowski, 2017). Although the EV credits market is likely to become very active in China in coming years, Tesla is unlikely to sell many credits due to competition from high volume, low cost Chinese electric vehicle manufacturers (see Table 7 for sales of NEV vehicles in China). This is not to say that China is an unattractive market for Tesla – in fact, quite the opposite.

Table 7

<table>
<thead>
<tr>
<th>Vehicle</th>
<th>2017 Sales YTD</th>
<th>2017 SOM</th>
<th>Price (excl. subsidies)</th>
</tr>
</thead>
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<tr>
<td>BAIC EC-Series</td>
<td>49,191</td>
<td>10.0%</td>
<td>$23,000</td>
</tr>
<tr>
<td>BYD Song PHEV</td>
<td>22,910</td>
<td>4.7%</td>
<td>$42,400</td>
</tr>
<tr>
<td>BYD e5</td>
<td>20,649</td>
<td>4.2%</td>
<td>$33,400</td>
</tr>
<tr>
<td>JAC iEV6S</td>
<td>18,585</td>
<td>3.8%</td>
<td>$26,000</td>
</tr>
<tr>
<td>Geely Emgrand EV</td>
<td>17,990</td>
<td>3.7%</td>
<td>$39,000</td>
</tr>
<tr>
<td>Chery eQ</td>
<td>16,762</td>
<td>3.4%</td>
<td>$24,500</td>
</tr>
<tr>
<td>SAIC Roewe eRX5 PHEV</td>
<td>15,042</td>
<td>3.1%</td>
<td>$40,000</td>
</tr>
<tr>
<td>BYD Qin PHEV</td>
<td>11,937</td>
<td>2.4%</td>
<td>$31,000</td>
</tr>
</tbody>
</table>


7. Non-Financial Challenges

Negative publicity

Tesla has encountered a lot of negative publicity lately. As a result, the stock price has been negatively affected. The company is heavily dependent on its stock price and it is paramount to maintain high market valuation. Therefore, Tesla has to address all of the current issues in order to avoid even more serious consequences.

Tesla’s internal issues led to numerous individuals and organizations seeking legal action against the company. While Tesla used to resolve disputes against the dealerships and dealership associations in the past, the company has never encountered so many lawsuits at once. These lawsuits and complaints are related to issues such as (1) failure to provide employees with proper meal and rest breaks, (2) denying overtime pay, (3) failure to give proper notice about the job dismissals, (4) retaliatory action against
employees who supported the union campaign and raised concerns about workplace conditions, and (5) racial discrimination and anti-LGBT threats in the workplace. In addition, constantly making false and misleading statements about the company’s current and future performance has finally backfired. Tesla has recently been hit with a securities class-action lawsuit alleging that Tesla’s public statements about the Model 3 launch were materially false and misleading at all relevant times (Felton, 2017).

The issues mentioned in these lawsuits and complaints are either totally avoidable, or relatively insignificant. In my opinion, some of them could have been prevented if addressed immediately. In other words, Tesla could avoid all the negative publicity, but chose to do nothing. Because the company is constantly increasing the size of its workforce, I can attribute these missteps to inexperience dealing with a large number of workers. Although Tesla does not seem to provide the best possible workplace environment, certain issues are caused by the company’s attitude towards seemingly minor problems which lead to major consequences. As an outsider, I would prefer to see the company take a proactive approach in such situations, thus converting negative news into positive publicity.

Supplier base selection

In most cases, Tesla does not enter into long-term agreements with its suppliers. Hence, suppliers have no incentive to work with Tesla on improving the quality of parts and efficiency of their manufacturing processes – the concept taught in every book on the lean production system. In addition, Tesla admits that the majority of parts and components are single-sourced meaning that no alternative sources of raw materials exist in case certain suppliers fail to deliver quality parts on time. Most likely, Tesla is actively looking for quantity discounts and, as a low volume auto manufacturer, has no other option. Although this is my guess, Tesla is probably using the same strategy as Henry Ford II used in the 1950s when he asked suppliers to bid on the contract to supply certain parts. This approach is outdated and is bound to cause major problems at some point in the future. The use of a lean supply chain should be a better solution – it is crucial to
identify suppliers willing to work with Tesla engineers in order to come up with a high-quality product at an acceptable cost. Vertical integration might be necessary in certain circumstances, but taking design and manufacturing of every component in-house (even after a frustrating experience dealing with suppliers) is not a sustainable long-term strategy. As business schools and common sense teach, companies are usually better off focusing on their core competencies rather than constantly looking for new ones.

**Elon Musk’s management style**

Elon Musk is often referred to as the visionary of the 21st century, but some of his managerial decisions are highly controversial. One example is his inability to retain senior-level employees. There are multiple reports of senior executives leaving Tesla in recent months ahead of the most important product launch in the company history. Many of them spent less than a year with Tesla. Another example is the way Musk deals with lower-level employees. Tesla fired hundreds of employees several weeks ago, allegedly due to unsatisfactory performance. While some employees who were fired reported that this layoff was a cost-cutting effort and had nothing to do with their performance, others stated that their support of unionization at the Tesla Factory in Fremont, CA was the reason. In any case, even though Tesla claimed that additional compensation had boosted employee morale, the firings actually hurt the morale in the targeted departments and the company as a whole (Lee, 2017). The final example is the fact that the CEO of Tesla is also associated with the aerospace company SpaceX as well as with several other small startups including Hyperloop, OpenAI, Neuralink and The Boring Company. I concur with the analysts who express their concerns regarding Elon Musk’s attention spreading too thin because of the multiple projects he is involved in. Overall, although Elon Musk is responsible for much of Tesla’s success, he has never managed such a large company and his inexperience as an executive is evident.

The majority of other analytic papers and articles on Tesla tend to focus on the issues associated with (1) intensified competition in the electric vehicle market, (2) higher than necessary R&D and capital expenditures caused by vertical integration, and (3) potential
failure to reach an adequate level of manufacturing efficiency. Although these issues are considered to be the main threats to the long-term success of Tesla, they are excluded from the discussion in this part of the paper in order to avoid unnecessary “story-telling” based on existing research. On the contrary, the emphasis is placed on the current and future challenges which are often neglected by the analysts, but are equally important for the company. All in all, both sets of challenges may potentially have a negative impact on the bottom line. The key takeaway is that the electric carmaker must be prepared to deal with serious challenges it is likely to encounter sooner or later.

8. The Future of Tesla: Model 3 and Beyond

Most experts and analysts concur that the Model 3 introduction is the most important product launch in the company history. Without doubt, the future success of Tesla largely depends on the success of this mass-market sedan. So far, the ramp-up in the production of the Model 3 has not been successful – due to serious issues with suppliers and multiple bottlenecks in the production process, the company has failed to meet its aggressive production targets. In addition, the existing issues of poor overall quality and reliability could “undermine Tesla’s brand and potentially overwhelm its service network” (Baron, 2017). In essence, the Model 3 is the ultimate test not only for Tesla as a mass-market car manufacturer, but also for electric vehicles in general as [potentially] the major mode of transportation. Therefore, the final section of the paper is dedicated to the analysis of the Model 3 and its overall impact on the automotive segment of the business.

The following three pages present the quantitative analysis of the new vehicle. First, based on the UBS research report, I determine the average cost of manufacturing the base version of the Model 3 at full capacity of the production line. The different scenarios are presented: an optimistic management case (1) and a realistic base case (2). Next, based on a series of assumptions, I estimate the actual average prices and contribution margins for both scenarios. Lastly, all the available information is used to conduct a breakeven analysis of the automotive segment of the company for 2018.
## Model 3 Comparison

<table>
<thead>
<tr>
<th>(Base Versions)</th>
<th>Chevy Bolt</th>
<th>BMW 330i</th>
<th>Tesla Model 3 (1)</th>
<th>Tesla Model 3 (2)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSRP</td>
<td>36,620</td>
<td>38,750</td>
<td>35,000</td>
<td>35,000</td>
<td></td>
</tr>
<tr>
<td>Dealer/Incentives (15%)</td>
<td>4,777</td>
<td>5,054</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Price charged by OEM</td>
<td>31,843</td>
<td>33,696</td>
<td>35,000</td>
<td>35,000</td>
<td></td>
</tr>
<tr>
<td>Battery cost ($ per kWh)</td>
<td>205</td>
<td>130</td>
<td>160</td>
<td></td>
<td>Better performance vs. Bolt</td>
</tr>
<tr>
<td>Battery capacity (kWh)</td>
<td>60</td>
<td>55</td>
<td>55</td>
<td></td>
<td>Half of Model S initial accrual</td>
</tr>
<tr>
<td>Total battery pack cost</td>
<td>12,300</td>
<td>7,150</td>
<td>8,800</td>
<td></td>
<td>Assume higher labor costs</td>
</tr>
<tr>
<td>Powertrain cost</td>
<td>3,778</td>
<td>8,500</td>
<td>4,500</td>
<td>4,500</td>
<td>More aluminum content vs. Bolt</td>
</tr>
<tr>
<td>Projected warranty expense</td>
<td>700</td>
<td>674</td>
<td>1,700</td>
<td>1,700</td>
<td>Autopilot hardware</td>
</tr>
<tr>
<td>Direct labor</td>
<td>2,400</td>
<td>2,800</td>
<td>3,600</td>
<td>3,600</td>
<td></td>
</tr>
<tr>
<td>Direct materials</td>
<td>1,500</td>
<td>1,800</td>
<td>2,200</td>
<td>2,200</td>
<td></td>
</tr>
<tr>
<td>Supplier components</td>
<td>8,000</td>
<td>10,400</td>
<td>12,000</td>
<td>14,000</td>
<td></td>
</tr>
<tr>
<td>Optional features</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Contribution margin</td>
<td>3,165</td>
<td>9,522</td>
<td>3,850</td>
<td>200</td>
<td></td>
</tr>
</tbody>
</table>

Source: UBS Report; compiled by author.
### Management and Base Cases

<table>
<thead>
<tr>
<th></th>
<th>Management Case</th>
<th>Base Case</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MSRP</strong></td>
<td>47,500</td>
<td>47,500</td>
<td></td>
</tr>
<tr>
<td><strong>Average battery pack cost</strong></td>
<td>8,710</td>
<td>10,720</td>
<td>Assume 60 percent of customers purchase long-range battery</td>
</tr>
<tr>
<td>Powertrain cost</td>
<td>4,500</td>
<td>4,500</td>
<td></td>
</tr>
<tr>
<td>Projected warranty expense</td>
<td>1,700</td>
<td>1,700</td>
<td></td>
</tr>
<tr>
<td>Direct labor</td>
<td>3,600</td>
<td>3,600</td>
<td></td>
</tr>
<tr>
<td>Direct materials</td>
<td>2,200</td>
<td>2,200</td>
<td></td>
</tr>
<tr>
<td>Supplier components</td>
<td>12,000</td>
<td>14,000</td>
<td></td>
</tr>
<tr>
<td><strong>Optional features</strong></td>
<td><strong>3,550</strong></td>
<td><strong>3,550</strong></td>
<td></td>
</tr>
<tr>
<td>Contribution margin</td>
<td><strong>11,240</strong></td>
<td><strong>7,230</strong></td>
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</tr>
</tbody>
</table>

### Average Price Assumptions

<table>
<thead>
<tr>
<th>(Options)</th>
<th>Price ($)</th>
<th>Take Rate (%)</th>
<th>Incremental Revenue ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Long-Range Battery</td>
<td>9,000</td>
<td>60</td>
<td>5,400</td>
</tr>
<tr>
<td>Premium Upgrades package</td>
<td>5,000</td>
<td>75</td>
<td>3,750</td>
</tr>
<tr>
<td>Enhanced Autopilot</td>
<td>5,000</td>
<td>40</td>
<td>2,000</td>
</tr>
<tr>
<td>Full Self-Driving Capability</td>
<td>3,000</td>
<td>5</td>
<td>150</td>
</tr>
<tr>
<td>Paint</td>
<td>1,000</td>
<td>90</td>
<td>900</td>
</tr>
<tr>
<td>Sport Wheels</td>
<td>1,500</td>
<td>20</td>
<td>300</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>$12,500</strong></td>
</tr>
</tbody>
</table>

Source: Compiled by author.
# TESLA, INC. BREAKEVEN ANALYSIS FOR 2018

## MANAGEMENT CASE

### AMOUNTS SHOWN IN U.S. DOLLARS

<table>
<thead>
<tr>
<th>AVERAGE CONTRIBUTION MARGIN</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model S &amp; Model X</td>
<td>40%</td>
</tr>
<tr>
<td>Model 3</td>
<td>24%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Projected Unit CM</th>
<th>$9,090</th>
</tr>
</thead>
<tbody>
<tr>
<td>Projected Production in 2018</td>
<td>275,000</td>
</tr>
</tbody>
</table>

### TOTAL CONTRIBUTION MARGIN

<table>
<thead>
<tr>
<th>Model S &amp; Model X</th>
<th>$4,000,000,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 3</td>
<td>$2,499,750,000</td>
</tr>
<tr>
<td>TOTAL</td>
<td>$6,499,750,000</td>
</tr>
</tbody>
</table>

### FIXED COSTS

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>D&amp;A</td>
<td>$2,300,000,000</td>
</tr>
<tr>
<td>R&amp;D</td>
<td>$1,700,000,000</td>
</tr>
<tr>
<td>SG&amp;A</td>
<td>$3,010,000,000</td>
</tr>
<tr>
<td>TOTAL FIXED COSTS</td>
<td>$7,010,000,000</td>
</tr>
</tbody>
</table>

### EBIT (LOSS)

<table>
<thead>
<tr>
<th></th>
<th>($510,250,000)</th>
</tr>
</thead>
</table>

### RESULTS

| BREAKEVEN POINT (UNITS): | 331133 |

Source: Compiled by author.

## BASE CASE

### AMOUNTS SHOWN IN U.S. DOLLARS

<table>
<thead>
<tr>
<th>AVERAGE CONTRIBUTION MARGIN</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model S &amp; Model X</td>
<td>40%</td>
</tr>
<tr>
<td>Model 3</td>
<td>15%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Projected Unit CM</th>
<th>$5,080</th>
</tr>
</thead>
<tbody>
<tr>
<td>Projected Production in 2018</td>
<td>275,000</td>
</tr>
</tbody>
</table>

### TOTAL CONTRIBUTION MARGIN

<table>
<thead>
<tr>
<th>Model S &amp; Model X</th>
<th>$4,000,000,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 3</td>
<td>$1,397,000,000</td>
</tr>
<tr>
<td>TOTAL</td>
<td>$5,397,000,000</td>
</tr>
</tbody>
</table>

### FIXED COSTS

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>D&amp;A</td>
<td>$2,300,000,000</td>
</tr>
<tr>
<td>R&amp;D</td>
<td>$1,700,000,000</td>
</tr>
<tr>
<td>SG&amp;A</td>
<td>$3,010,000,000</td>
</tr>
<tr>
<td>TOTAL FIXED COSTS</td>
<td>$7,010,000,000</td>
</tr>
</tbody>
</table>

### EBIT (LOSS)

|                      | ($1,613,000,000) |

### RESULTS

| BREAKEVEN POINT (UNITS): | 592520 |

Source: Compiled by author.
The cost analysis of the Model 3 is based primarily on the findings of the research analysts from UBS. Some of their estimates have been modified in order to reflect the current state of affairs. First, the battery cost per kWh is supposed to be lower for both cases. While the management case assumes a 30 percent cost reduction (projected by Elon Musk) due to economies of scale and lower cost of raw materials, the base case takes into account the same sources of cost savings, but to a lesser extent. Second, the direct labor costs are estimated to be higher for the Model 3 than for other vehicles. As mentioned earlier in the paper, Tesla is known for using significant amount of manual labor on its production lines. Finally, the total cost of supplier components is significantly higher for the Model 3 because of the expensive Autopilot hardware which is installed on every vehicle produced in the Tesla Factory. The actual cost of the hardware package is highly uncertain and the two scenarios reflect my best guesstimates. On the whole, these modifications show a more realistic picture of the contribution margins on the Model 3 which are quite low for a $35,000 car.

Nevertheless, the margins improve and get close to the company’s projections when the additional options are taken into consideration. Tesla has always relied heavily on the higher-priced versions of its vehicles to generate healthy margins. The interesting fact is that the prices of the options are almost identical for all the models. At the same time, the base price of the Model 3 is only $35,000 compared to almost $80,000 for the Model S or X. Therefore, the impact of additional options on the margins of a lower-priced vehicle is proportionately more sizable. The estimated take rates are arbitrary and the assumption of a 50 percent contribution margin on all options other than the battery size is taken from the UBS report. Although the actual take rates may be higher or lower and several other performance-related options may be introduced later on, I consider the estimated $47,500 MSRP to be reasonable. It is worth noting that the difference between the contribution margins of the two scenarios will have a significant impact on the breakeven point due to a high volume of sales of Tesla’s first mass-market vehicle.

The breakeven analysis of the automotive segment for 2018 begins with the fixed components for both scenarios. Based on the current demand, Model S and Model X
combined are projected to generate $10 billion in revenues and $4 billion in gross profit (excluding depreciation and amortization expense). In addition, Elon Musk’s comments suggest that weekly production of the Model 3 may reach 8,000 units per week by the end of 2018. This translates into roughly 275,000 units for the whole year. With regard to the fixed costs, the estimated D&A and R&D expenses are based on the current and past growth rates. And, as Figure 14 demonstrates, the estimated total SG&A expense is based on the average number of Tesla vehicles on the roads. The annual cost per vehicle has been falling steadily and I expect this trend to continue in 2018. The fixed portion of the SG&A expense does not include the cost of supporting $^{30}$ the fast-growing fleet of Model 3’s. This cost is treated as a variable cost and is subtracted from the contribution margin of the vehicle. Despite the high volume of sales, the total contribution margin

![SG&A Expense Divided by the Average Tesla Fleet Size]

Source: Compiled by author.

$^{30}$ I assume that Model 3 is twice less expensive to support than Model S or X.
generated by the Model 3 is insufficient in both scenarios. Nevertheless, although the base case scenario is a more likely outcome for Tesla, the management case scenario can potentially bring the company close to the breakeven point. The actual outcome depends on the speed and efficiency of the Model 3 production ramp-up. All in all, the breakeven analysis suggests that Tesla will most likely report another loss close to $1 billion in 2018 and will target 2019 as the first profitable year in the company history. I abstain from making further projections regarding the future of the company due to a high number of variables such as the impact of subsequent product launches, the changes in the economic and competitive environments, and the potential battery technology breakthroughs. The key takeaway from this quantitative analysis is that the overall impact of the Model 3 on the bottom line may even be negative if the electric carmaker continues to use inefficient manufacturing processes, thus failing to reap the benefits of economies of scale to a full extent.

Nowadays, all manufacturers strive to adopt the lean production system developed by Toyota in the 1960s. With regard to the automotive industry, the unquestionable benefits of this system are critical for long-term success. However, despite having experienced managers on the executive team, Tesla does not make an impression of a lean manufacturer. Although some areas of the business appear to be less wasteful (the direct sales model, research and development activities, etc.), the inefficient methods used to run the factories and coordinate the supply chain cause the vast majority of Tesla’s existing problems. In theory, implementing all the elements of lean production from top to bottom of the company will not only prepare Tesla for the upcoming challenges, but also increase the positive effects of economies of scale by an order of magnitude.

From the very beginning, one of the main objectives of the Model 3 introduction was achieving substantial cost reductions due to economies of scale. The potential sources of economies of scale include, but are not limited to, (1) battery manufacturing, (2) vehicle final assembly and parts manufacturing, (3) procurement of parts and components, and (4) coverage of fixed costs.
The battery pack is the most expensive component of an electric vehicle. Therefore, continuously decreasing the battery cost per kWh is essential for achieving economies of scale in electric vehicle manufacturing. In order to bring the unit production cost down, Tesla plans to use a new battery cell technology in the battery packs for the Model 3 (Ward, 2017). In addition, the company will ride the learning curves associated with battery cell manufacturing (performed by Panasonic at the Gigafactory 1) and battery pack assembly. The cumulative output of the Gigafactory 1 is expected to double several times over the next few years.

Because Tesla is a highly vertically-integrated company, many parts and components are being designed and manufactured by Tesla. Consequently, the electric carmaker will benefit from the learning rates\(^\text{31}\) related to both parts manufacturing and final assembly. The cumulative output of the Tesla Factory will [probably] more than double in 2018, leading to significant labor cost savings on a per unit basis. These savings will be derived mainly from a more efficient production process and a fewer number of defects per vehicle.

In addition to riding its own learning curves, the company is also supposed to benefit from the suppliers’ learning rates and economies of scale. In other words, an increased demand for certain parts and components will not only help the supplier double the output quicker, but also achieve better fixed cost coverage.

Similar to suppliers, Tesla is also expected to improve its coverage of fixed costs which include SG&A, D&A and R&D expenses. First, the company will be able to leverage the benefits of the direct sales model to a full extent. The sales will definitely grow more rapidly than the number of company-owned stores, galleries and service centers. Moreover, certain administrative expenses will remain fixed in the near term. Second, depreciation and amortization expense per unit of production will decrease over time in proportion to an increase in the asset utilization rate. Based on the company’s

\[^{31}\text{Learning Curve} = 100\% - \text{Learning Rate}\]
most recent public statements, the current production rates at the Tesla Factory and the Gigafactory 1 do not represent the actual capacity of those facilities. Finally, due to better allocation of spending, Tesla will also reduce the amount of research and development expenses per vehicle delivered. Overall, the reduction in the average total cost stemming from the improved fixed cost coverage is the primary driver of economies of scale for Tesla.

While there are many potential sources of economies of scale for Tesla, the actual returns to scale will depend on multiple factors and may be negatively affected by certain aspects of the business such as rapid growth causing immense capital expenditures, flatter than expected learning curves, and/or wasteful manufacturing practices. Diseconomies of scale might also become a factor in the long run if the Tesla Factory in Fremont becomes too large. Nonetheless, the high-level problems discussed in this paper are not impossible to solve. The question is whether or not the company will get on the right track on time. The manufacturing and supply chain problems have to be addressed in the short run in order to be competitive in the long run. Ultimately, the strategy of Tesla is likely to prove successful, if executed carefully and thoughtfully.
Acknowledgements

Many thanks to Professor Gomes-Casseres and Professor McKay for their valuable contributions to this paper. I am very grateful for having the opportunity to work on my senior thesis under their guidance. This has been a challenging but ultimately rewarding experience. Professor Gomes-Casseres’ suggestions pertaining to the structure of the paper and the overall focus thereof have influenced the final product to a great extent. In my opinion, his main contribution – the idea of analyzing the value of Tesla from a qualitative perspective – has improved the paper significantly. Supposedly, further improvements could have been achieved, had I not refused to put a third of the paper into an appendix. Professor McKay’s insightful comments have helped identify and enhance numerous weak or unconvincing arguments throughout the paper. In essence, his involvement in the project not only improved the quality of the arguments, but also made me pay attention to minor details from the very beginning which led to major changes in the end. Once again, the paper could have been even better, had I not preferred to disagree with Professor McKay from time to time. On the whole, I benefitted a great deal from the complimentary skills and experiences of my advisors. Both of them encouraged me to look at each particular situation from completely different angles in order to deliver a sounder, more compelling final product.
Exhibit 1 The History of Tesla, Inc.

Tesla, Inc. designs, develops, manufactures, and sells electric vehicles and energy generation and storage products. The company is headquartered in Palo Alto, California.

- **July 2003**
  - Tesla Motors, Inc. was founded by Martin Eberhard and Marc Tarpenning.

- **July 2005**
  - Tesla signed a Roadster production contract with Lotus.

- **October 2006 - March 2008**
  - Tesla experienced major delays in development of the Roadster. In the meantime, Martin Eberhard stepped down as CEO. Michael Marks and Ze’ev Drori served as interim CEOs.

- **October 2008**
  - Elon Musk became the CEO of Tesla Motors, Inc.

- **June 2009**
  - Tesla raised $225 million in its IPO becoming the first American car company to go public since Ford in 1956.

- **February 2012**
  - Tesla unveiled the Model X - its first SUV featuring unique Falcon Wing rear doors and optional Dual Motor All-Wheel drive.

- **September 2012**
  - The company revealed the locations of the first six Supercharger stations.

- **June 2014**
  - Tesla announced that it will not initiate lawsuits against anyone who, in good faith, wants to use its technology.

- **October 2014**
  - The first version of Autopilot was introduced.

- **March 2016**
  - Tesla unveiled the Model 3 mid-sized electric sedan. The company announced $35,000 base price for the vehicle. As a result, customers placed $25,000 reservations within a week of the unveiling.

- **February 2017**
  - The company changed its name from Tesla Motors to Tesla.

Source: Numerous online articles; compiled by author.
### Exhibit 2 Description of the Components of the Income Statement

<table>
<thead>
<tr>
<th><strong>Revenues:</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Automotive</strong></td>
<td>Automotive revenue includes revenues related to deliveries of new vehicles, sales of regulatory credits to other automotive manufacturers, and specific other elements that meet the definition of a deliverable under multiple-element accounting guidance including free access to our Supercharger network, free internet connectivity, and future free over-the-air software updates.</td>
</tr>
<tr>
<td><strong>Automotive leasing</strong></td>
<td>Automotive leasing revenue includes revenue recognized under lease accounting guidance for our direct leasing programs as well as programs with resale value guarantees.</td>
</tr>
<tr>
<td><strong>Services and other</strong></td>
<td>Services and other revenue consists of vehicle repair and maintenance services, vehicle service plans and merchandise, sales of pre-owned Tesla vehicles, sales of electric vehicle powertrain components and systems to other manufacturers, and sales of non-Tesla vehicle trade-ins.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Cost of revenues:</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Automotive</strong></td>
<td>Cost of automotive revenues includes direct parts, material and labor costs, manufacturing overhead, including depreciation costs of tooling and machinery, shipping and logistic costs, vehicle internet connectivity costs, allocations of electricity and infrastructure costs related to our Supercharger network, and reserves for estimated warranty expenses. Cost of revenues also includes adjustments to warranty expense and charges to write down the carrying value of our inventory when it exceeds its estimated net realizable value and to provide for on-hand inventory that is either obsolete or is in excess of forecasted demand.</td>
</tr>
<tr>
<td><strong>Automotive leasing</strong></td>
<td>Cost of automotive leasing revenue includes primarily the amortization of operating lease vehicles over the lease term, as well as warranty expenses recognized as incurred.</td>
</tr>
<tr>
<td><strong>Services and other</strong></td>
<td>Cost of services and other revenue includes direct parts, material and labor costs, manufacturing overhead associated with the sales of electric vehicle powertrain components and systems to other manufacturers, costs associated with providing maintenance and development services, and cost associated with sales of pre-owned vehicles.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Operating expenses:</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Research and development</strong></td>
<td>Research and development (R&amp;D) expenses consist primarily of personnel costs for our teams in engineering and research,</td>
</tr>
<tr>
<td></td>
<td>supply chain, quality, manufacturing engineering and manufacturing test organizations, prototyping expense, contract and professional services and amortized equipment expense.</td>
</tr>
<tr>
<td>-----------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Selling, general and administrative</td>
<td>Selling, general and administrative (SG&amp;A) expenses consist primarily of personnel and facilities costs related to our stores, marketing, sales, executive, finance, human resources, information technology and legal organizations, as well as litigation settlements and fees for professional and contract services.</td>
</tr>
</tbody>
</table>

Source: Tesla SEC filings; compiled by author.
Exhibit 3a Average Light-Vehicle Dealership Gross Profit Mix

Source: Nada Industry Analysis Division; compiled by author.

Exhibit 3b Average Light-Vehicle Dealership Revenue Mix

Source: Nada Industry Analysis Division; compiled by author.
Exhibit 3c Luxury Dealership Gross Profit Mix

Service & Parts 59%
New-vehicle department 23%
Used-vehicle department 18%

Source: Nada Industry Analysis Division; compiled by author.

Exhibit 3d Luxury Dealership Revenue Mix

Service & Parts 14%
New-vehicle department 55%
Used-vehicle department 31%

Source: Nada Industry Analysis Division; compiled by author.
Exhibit 4a Tesla Roadster


Exhibit 4b Tesla Model S

Source: https://www.digitaltrends.com/cars/tesla-limits-launch-mode/
Exhibit 4c Tesla Model X


Exhibit 4d Tesla Model 3

Source: http://onlinepitstop.com/tesla-model-3-delivered-28th-july/
Exhibit 4e Tesla Semi Truck

Source: http://www.carmagazine.co.uk/car-news/first-official-pictures/tesla/tesla-electric-truck-details-and-pictures/

Exhibit 4f Next-Generation Tesla Roadster

Exhibit 5 Key concerns of consumers about EVs

- High purchase price: 48%
- Limited range on single charge: 43%
- Limited access to plug-in stations: 42%
- Battery life: 39%
- Lengthy charge times: 30%
- Limited access to service stations: 26%
- Technology not fully developed yet: 23%
- Don't know enough about them: 22%
- Cumbersome and inconvenient: 20%
- Cost of running the car: 19%
- Performance: 15%
- Lack of choices: 14%
- Not safe or reliable: 13%
- Design and appearance of vehicle: 13%
- Faster depreciation: 12%
- Other: 11%
- Government incentives (tax, etc.): 11%
- Noise level: 0%

Source: UBS Report.
Exhibit 6 Employer costs per hour worked, wages and salaries and benefit costs by bargaining status, private industry workers, March 2001 to March 2011

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<th>Nonunion wages</th>
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Bibliography


Pontes, Jose. “BAIC EC-Series Scores 11,000 Sales in October! (Record Electric Car Sales in China!).” *CleanTechnica*, Sustainaible Enterprises Media, Inc., 21 Nov.


