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What Contribute to the Growth of EV Automakers' Valuation? The Case of Tesla and Nio

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Abstract

What does contribute to the tremendous valuation of electric vehicles (EVs) producers? Two prominent and representative EV producers, Tesla, and Nio are carefully examined and evaluated in this case study. The significant valuation growth of EV producers can be attributed to a range of factors, including industry growth expectations and unrelated to the growth in R&D expenses and the volatility of Google Search volume. Using multiple valuation methods, I conclude that EV producers are currently overvalued.

Keywords: stock valuation, growth motivation, Tesla, Nio, EV automakers

1. Introduction

In this paper, two questions were investigated: (1) What actors contribute to the significant growth of EV automakers? (2) What is the reasonable valuation of EV automakers at present? Although several papers have analyzed the stock price of EV automakers, most have only focused on the case of Tesla and firm-specific factors. Here, we attempt to analyze the growth of EV automakers at the industry level, focusing on two companies: Tesla (NASDAQ: TSLA) and Nio (NYSE: Nio). The reason why Tesla is chosen is because this is currently the largest firm and can be considered the most successful EV producer in the industry, while Nio is chosen because of continuous technological breakthroughs and innovations. Nio is also said to be the second Tesla in the industry. Therefore, one believes that Nio and Tesla are the most suitable samples for this paper.

Our findings suggest that several factors have contributed to the growth of EV companies, including favorable policies, expectations of new technology, and consumer preferences. However, the R&D investments and change in public exposure are not responsible for changes in the two firms' share price. It is also found that both Tesla and Nio are likely overvalued, according to classic valuation models including P/E, P/S, and DCF.

The rest of this paper is organized as follows. Section 2 provides background information on the research. Sections 3 through 6 describe the potential hypothesis of factors driving the growth of EV automakers. Section 7 provides a reasonable valuation for Tesla and Nio, while Section 8 concludes the paper.

2. Research Background

In literature, several papers have pointed out that stock price growth is directly related to growth in core business and fundamental financial indexes. Abarbanell and Bushee (1997) find that changes in the core business result are informative about subsequent earnings, and investors incorporate this information into their decisions, which affects the stock prices. Tarmidi et al. (2020) investigated the impact of financial ratios and stock prices and stated that financial ratios significantly impact stock prices. This is also the case of the legacy group in the automobile industry (Mercedes-Benz, Volkswagen, Toyota, Ford, General Motors) as the valuation increases with the growth in earnings. However, this is not the case for Tesla and Nio (the EV group), as the P/S value is much higher than the average in the industry (See table 1). More specifically, several manuscripts are trying to analyze the valuation of EV automakers. Arnott et al. (2021) stated that the electric vehicle industry is an example of a market delusion, and as time continues, many firms will fall. The valuation of the industry will recede to more reasonable levels. Le, Ho (2021), in their bachelor thesis, stated that Tesla's valuation is affected by several factors, such as business ecosystem, strategy, and the U.S. government's financial support; however, this thesis's limitation is that it only takes into account one atypical case of the industry.

Table 1. P/S value of automakers

	2018	2019	2020	2021	2022
Ford	0.1942	0.2435	0.2750	0.6088	0.2958
GM	0.3185	0.3734	0.4866	0.6702	0.3049
Toyota	0.6059	0.7022	0.8573	0.9142	0.6979
Volkswagen	0.2858	0.3474	0.3887	0.4394	0.2625
Mercedes-Benz	0.2858	0.3063	0.4233	0.4641	0.3576
Tesla	2.68	3.08	21.2	19.7	4.77
Nio	9.29	3.79	31.6	9.01	3.99

Source: Financial statement of companies.

As seen in Table 1, the P/S of the two EV automakers investigated are much higher than that of traditional automakers. In the case of Tesla, the P/S value was around 2.6 -3.1 in 2018 and 2019 before reaching its highest value, 21.2 in 2020, and reducing back to 4.7 in 2022. This trend is similar for Nio, as P/S peaked at 31.6 in 2020 and 3.99 in 2022, but still higher than the traditional car makers.

These statistics challenge the usual idea of firm valuation and suggest that the motivation for the growth of EV automakers is different from traditional automakers, and it did not arise from an increase in financial performance. Two questions raised here are (1) Which factor influenced the growth of EV automakers and (2) Whether EV automakers are overvalued on the stock market. Below, I will analyze three reasons EV automakers' valuations increased recently: favorable policies, technological advancement, and an expectation of customer preference in the future. Also, I will use the P/S and DCF methods to estimate a reasonable valuation for three EV automakers in this paper.

3. Electric Vehicles Promotion Policy

3.1 Hypothesis & Methodology

Government is playing a big role in promoting electric vehicles' development. EVs are getting tax deduction in many countries, which leads to a reduction in registered price and an increase in quantity demanded. Therefore, I hypothesize favorable policies to promote the production of electric vehicles globally can contribute to the growth in the stock price of EV automakers. This is because the policies illustrate that electric vehicles are encouraged to grow in the future with the subsidies and favorable policies of the government.

Brown and Warner (1985) utilize the event study method, which is a statistical method to evaluate the effects of an event on an outcome. The same method will be applied to determine the effect of Electric vehicles promotion policies announcement effects on the valuation and performance of EV automakers' stocks in the short term.

Previously, several papers analyzed the effects of fiscal and monetary policy announcements on the performance of stocks. Furceri et al. (2021) suggest that fiscal policy announcements have been effective in stimulating economic activity, boosting confidence, and reducing unemployment, but their effect varies by type of measure and country characteristics. Ciorcirlan, Nitoi (2022) pointed out a high degree of complementarity between fiscal and monetary policy: well-timed fiscal policy announcements complemented ECB's monetary programs, protecting sovereign bond market from risk aversion.

This paper will analyze the cumulative abnormal return (CAR) of two electric vehicles stock (Tesla and Nio) in [-1, +1], [-2, +2], and [-10, 0] timeframe at the policy announcement. The abnormal return is calculated using the following formula:

$$\text{Abnormal return} = \text{Actual return} - \text{Actual Market return}*\beta$$

In which

Actual return: Stock return in the given timeframe

Expected return: Return of the S&P500 index in the given timeframe

β: covariance between the stock return and the market index return in the previous six months

In this paper, I analyze the stock CAR after the announcement of 12 announcements between 2019 and 2021 (in which there are four policies of the United States government, four of the European Union, and four of the Chinese government). The list of events and the specific results are presented in section 3.2 data.

3.2 Data & Measurement

Table 2. List of 12 policy announcement events used in section 3

No	Date	Policy Description
		The United States Government Policy
(1)	13/12/2019	Illinois reduced its annual EV registration from $251 to $35
(2)	17/1/2020	New Jersey passed a law that requires all new light-duty vehicles purchased or leased by state agencies to be zero-emission by 2035
(3)	10/03/2020	The Federal Transit Administration announced $130 million in grants for the construction of EV charging stations and other infrastructure.
(4)	25/6/2020	California Air Resources Board (CARB) adopted new clean car standards that require automakers to sell more zero-emission vehicles in the state beginning in 2023.
		Chinese Government Policy
(5)	26/3/2020	The Chinese government announced the extended subsidy program for NEVs to the end of 2022.
(6)	22/6/2020	China announced the revision of the New Energy Vehicle (NEV) credit system, and the requirements became increasingly stringent, promoting EVs.
		China's State Council announced plans to build 600,000 public charging points, up from 500,000 in 2019.
(7)	26/10/2020	The Chinese government announced that NEVs must account for 20% of new car sales by 2025, up from a previous target of 12%
(8)	1/2/2021	The Chinese government launched the national carbon credit trading system. NEV manufacturers can earn carbon credit for producing and selling EVs, which can be sold to other companies.
		The European Union Policy
(9)	31/7/2020	The EU released the Clean Mobility Package, which includes measures to promote the deployment of EV charging structures and stricter CO2 emissions standards for vehicles.
(10)	8/10/2020	The European Parliament approved the Connecting Europe Facility (CEF) for the Transport program, providing €1.4 billion in funding for the deployment of EV charging infrastructure across the EU.
(11)	21/4/2021	The EU adopted new CO2 emissions standards for cars and vans, requiring a 55% reduction in CO2 emissions from new cars by 2030 compared to 2021 levels.
(12)	19/5/2021	The European Commission announced a plan to invest €2.9 billion to support electric vehicles battery manufacturing and research.

Source: Summarized by the author.

Table 3. Abnormal return of Tesla

No	Date	Beta Coeficient	[-1, +1]	[-2, +2]	[-10, 0]
			The United States Government Policy		
(1)	13/12/2019	1.39	5.03%	5.12%	17.30%
(2)	17/1/2020	1.44	6.39%	8.37%	17.70%
(3)	10/03/2020	1.63	4.61%	5.40%	-17.75%
(4)	25/6/2020	1.23	1.35%	3.46%	19.88%
			Chinese Government Policy		
(5)	26/3/2020	1.25	-7.67%	-8.99%	0.67%
(6)	22/6/2020	1.22	0.06%	-2.06%	2.33%
(7)	26/10/2020	1.41	3.64%	0.38%	-1.07%
(8)	1/2/2021	1.93	4.75%	1.91%	4.69%
			The European Union Policy		
(9)	31/7/2020	1.30	-1.87%	-2.49%	-2.3%
(10)	8/10/2020	1.44	-0.07%	0.38%	-3.64%
(11)	21/4/2021	2.14	0.10%	1.16%	8.32%
(12)	19/5/2021	2.01	-0.07%	1.18%	-1.99%

Source: Yahoo Finance, summarized by the author.

Table 4. Abnormal return of Nio

No	Date	Beta Coeficient	[-1, +1]	[-2, +2]	[-10, 0]
		The United States Government Policy			
(1)	13/12/2019	1.74	8.00%	11.79%	14.87%
(2)	17/1/2020	1.44	18.13%	10.23%	23.20%
(3)	10/03/2020	0.92	1.09%	3.39%	-12.44%
(4)	25/6/2020	0.68	1.50%	-3.10%	15.01%
		Chinese Government Policy			
(5)	26/3/2020	0.71	1.00%	-1.00%	-3.66%
(6)	22/6/2020	0.65	3.43%	1.69%	13.04%
(7)	26/10/2020	0.78	6.40%	4.60%	22.77%
(8)	1/2/2021	1.68	-7.24%	-2.57%	-1.37%
		The European Union Policy			
(9)	31/7/2020	0.72	10.41%	6.34%	7.29%
(10)	8/10/2020	0.72	-2.82%	1.39%	13.26%
(11)	21/4/2021	1.94	7.15%	10.90%	3.1%
(12)	19/5/2021	1.76	-0.93%	1.05%	5.17%

Source: Yahoo Finance, summarized by the author.

3.3 Discussion

From the calculation presented in Table 3 and Table 4, it is shown that EV promotion policy announcements have a significant impact on the performance of the two EV stocks investigated. For Tesla, only six frames witnessed insignificant abnormal returns (CAR > 1%), while that of Nio was only two. However, the impact can be positive and negative, and there are differences in abnormal returns between different time frames. Nio has a higher absolute value of abnormal return than Tesla, which might come from the fact that the number of shares of Nio is smaller and more concentrated. The most analogous event is event 3, 'The Federal Transit Administration announced $130 million in grants for the construction of EV charging stations and other infrastructure' as it leads to negative abnormal return for both firms. A potential reason is that both Tesla and Nio had already invested in infrastructures for their vehicle owners, therefore, this policy might not be considered a positive announcement for the two firms in this study.

From a geographical perspective, most US government policy announcements resulted in positive stock performance, with CAR varying from -5.46% to 9.21% for Tesla and -19.35% to 26.90% for Nio. I expect that this is because both companies are listed on the US Stock Market (NYSE and NASDAQ), investors would receive these announcements faster and react more volatility to that news. However, it is interesting that although Nio has no operation in the United States, its stock price reaction to US government policies is more volatile than China. Even though China is a large market for both Tesla and Nio (Nio only sells cars in China, and Tesla built a factory in Shanghai), these announcements mean an increase in future development opportunities. Several announcements resulted in significant adverse reactions, especially in the shorter period. This might be because there is a time lag from the policy announcement of the Chinese government to the appearance of those policies on United States news, as both companies are listed in the United States.

4. Industry Growth Expectation

4.1 Hypothesis & Methodology

The value of a firm can be the discounted value of the future cash flow (Discounted Cash-Flow Model), or it could be the sum of present value and all future dividends payment (Dividend Discounted Model). Therefore, a firm can lose money in the present, but if there is huge potential growth, the present valuation can still be high. In this paper, it is hypothesized that this is the case of Tesla and Nio (EV producers). The electric vehicle industry's faster growth compared to the traditional automobile industry will drive the stock price for companies with a significant market presence. It is expected that companies investing heavily in electric vehicle technology and production, including Tesla and Nio, will likely see significant growth in the stock market.

In order to test this hypothesis, I will compare the industry analysis that projected the future growth of the internal combustion engine vehicles (ICE) market and the electric vehicles market. Specifically, I will summarize data from McKinsey, PWC, and Goldman Sachs reports (Note 1, Note 2) to draw a comparison between the growth of ICE vehicles and electric vehicles.

4.2 Global Vehicle Production

According to McKinsey, global vehicle production dropped by 16.4% in 2020 due to the COVID-19 pandemic. The industry is also expected to recover slowly in the next few years, with a projected Cumulative average growth rate (CAGR) of 2.8% until 2026. PWC analysis also shows that global light vehicle sales fell by 14% in 2020, with sales in China, Europe, and the United States declining by 6%, 24%, and 15%, respectively.

However, despite this decline, the electric vehicle industry continued to grow, with global EV sales increasing by 43% in 2020, reaching a total of 3.2 million units (McKinsey, 2020). McKinsey report also showed that electric vehicles made up 4.6% of global passenger car sales in 2020 (from 2.5% in 2019). This data suggests that the electric vehicle industry is more resilient to market shocks than the traditional automobile industry.

4.3 Market Share

Regarding market share, the traditional vehicle industry faces increasing competition from the electric vehicle (EV) industry. McKinsey predicts that by 2030, 25% of all new vehicles sold globally will be electric, and the market share of electric vehicles is expected to grow. Goldman Sachs also predicts that in 2040, in Europe, new cars sold will be 100% electrified, while this index for the United States and China will be 85% and 68%, respectively (See figure 1). This statistic indicated a considerable growth potential and market expansion for EV automakers (also equivalent to a reduction in the market share of ICE vehicles), which motivated the stock price to increase in the last period.

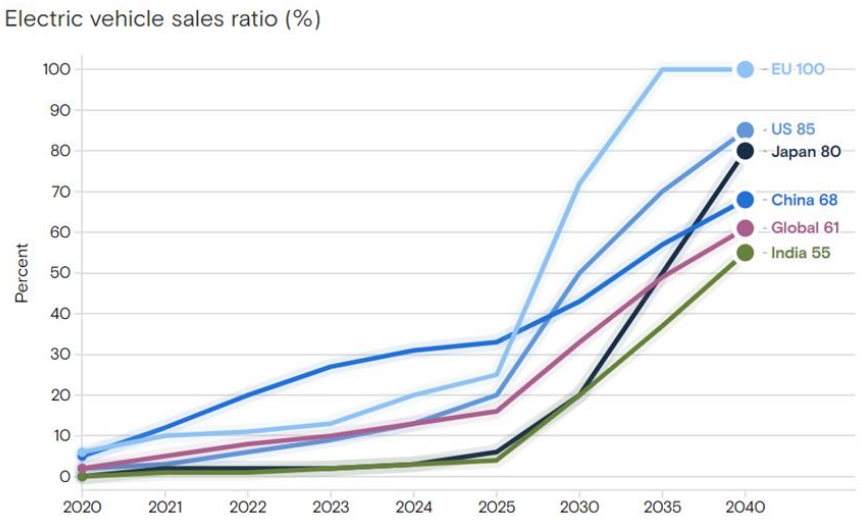

Figure 1. Predicted electric vehicle sales 2020-2040

Source: Goldman Sachs, IHS Global Insight.

4.4 Discussion

Sections 4.2 and 4.3 presented evidence to support the hypothesis that the faster growth of the electric vehicle automobile industry compared to the traditional automobile industry will drive stock price growth for companies with a significant presence in the electric vehicle market. The significant increase in market capitalization of electric vehicle companies suggests that investors are bullish on the industry and are willing to invest in companies with a presence in this market. This investor interest will likely result in stock price growth for these companies.

In contrast, the declining market share of traditional automobile companies may decrease investor interest, which could result in lower stock prices for companies in this industry. However, many traditional automobile companies are investing in electric vehicle production, which may help mitigate the impact of declining market share on stock prices.

Overall, the data and measurements suggest that the electric vehicle industry is generating significant investor interest and that companies with a presence in this market will likely experience stock price growth. However, the impact of this growth on individual stock prices will depend on factors such as the company's financial performance and its ability to capitalize on the growth of the electric vehicle market.

5. R&D Investment

5.1 Hypothesis & Methodology

Previous papers have pointed out a direct relationship between R&D investment and a firm's growth. Xiang et al. (2020) conclude that investors react negatively to the disruptive effect of changes to R&D expenditure, except for small firms. Similarly, Kwon, Jung (2014) showed that R&D contributes to the promotion of the market value of equity. In this paper, I hypothesize that the EV automakers' stock price has grown because of the growth in R&D investment. To test this hypothesis, I will run a regression test on the R&D expense/Total revenue to the share price growth to see if any direct relationships are drawn and whether R&D expense is a significant factor.

5.2 Data & Measurement

TSLA Regression Test

Regression Statistics	
Multiple R	0.233412286
R Square	0.054481295
Adjusted R Square	-0.031474951
Standard Error	0.007582258
Observations	13

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	3.64391E-05	3.64391E-05	0.633825905	0.442798063
Residual	11	0.000632397	5.74906E-05		
Total	12	0.000668836			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.049949809	0.004471211	11.17142658	2.41837E-07	0.040108739	0.059790878	0.040108739	0.059790878
X Variable 1	-1.60271E-05	2.01313E-05	-0.796131839	0.442798063	-6.03357E-05	2.82815E-05	-6.03357E-05	2.82815E-05

Figure 2. Tesla's relationship between R&D budget and share price

Source: Conducted by author.

Nio Regression Test

Regression Statistics	
Multiple R	0.770437441
R Square	0.593573851
Adjusted R Square	0.556626019
Standard Error	0.090755215
Observations	13

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.132321063	0.132321063	16.06518765	0.00205737
Residual	11	0.090601599	0.008236509		
Total	12	0.222922662			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.365865457	0.045121126	8.108517922	5.74544E-06	0.266554529	0.465176385	0.266554529	0.465176385
X Variable 1	-0.006399635	0.00159666	-4.008140173	0.00205737	-0.00991386	-0.002885411	-0.00991386	-0.002885411

Figure 3. Nio relationship between R&D budget and share price

Source: Conducted by author.

5.3 Discussion

Figure 1 and Figure 2 illustrate the Regression test result of Tesla and Nio, respectively, with the x-intercept as the R&D expense/revenue and the y-intercept as the growth of stock price quarter over quarter in three years from Q4/2019 to Q4/2022. The t-start for Nio was -4.00 which indicated that it is economically significant, while the t-start for Tesla was -0.796, which is relatively small and indicated that the relationship between Tesla share price and R&D investment was economically insignificant. When coming to the coefficients, both regression test pointed out relatively similar conclusion, as the coefficients of Tesla and Nio was both -0.000, concluding that the magnitude of the impact of R&D investments on share price was negligible. In short, it is unjustified that there is a direct relation between share price variation and R&D investments among the EV producers.

6. Public Exposure

6.1 Hypothesis & Methodology

Another hypothesis is that an increase in the public attention to EV producers could influence significantly on that EV producer stock's short-term price. In this paper, I used the Google Search Volume (GSV) as a measurement of public exposure to a company to test this hypothesis. If this is true, the expected result is that there is a positive relation between GSV growth and stock price growth. Even though there are relatively few previous literatures drawn a conclusion between share price and google search volume, Bui, Nguyen (2019) in their paper 'Stock market activity and Google Trends: the case of a developing economy' has showed a direct relationship between the google search volume and trading volume.

A regression test will be performed in the following question to test if there is a connection between stock price growth and google search volume. In the regression test, the x-intercept will be the search volume change (%) on a week-over-week basis and the y-intercept will be the stock price change (%) on a week-over-week basis.

6.2 Data & Measurement

Tesla Regression Test

Regression Statistics	
Multiple R	0.032450803
R Square	0.001053055
Adjusted R Square	-0.004928664
Standard Error	0.10491185
Observations	169

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.001937644	0.001937644	0.176045508	0.675333183
Residual	167	1.83808487	0.011006496		
Total	168	1.840022515			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.017055074	0.008110499	0.419577773	0.036978911	0.001042751	0.033067398	0.001042751	0.033067398
X Variable 1	0.016134527	0.038454198	2.102838972	0.675333183	-0.05978448	0.092053534	-0.05978448	0.092053534

Figure 4. Tesla's relationship between google trade volume and share price

Source: Conducted by author.

Nio Regression Test

Regression Statistics	
Multiple R	0.304426104
R Square	0.092675253
Adjusted R Square	0.08724217
Standard Error	0.13310629
Observations	169

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.302214052	0.302214052	17.05758299	5.71931E-05
Residual	167	2.958786523	0.017717285		
Total	168	3.261000575			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.015189862	0.010304009	1.474170101	0.142318373	-0.005153044	0.035532769	-0.005153044	0.035532769
X Variable 1	0.146058712	0.035364598	4.130082685	5.71931E-05	0.076239414	0.21587801	0.076239414	0.21587801

Figure 5. Nio's relationship between google trade volume and share price

Source: Conducted by author.

6.3 Discussion

Figure 3 and Figure 4 illustrate the Regression test result of Tesla and Nio, respectively, with the x-intercept as the R&D expense/revenue and the y-intercept as the growth of stock price week-over-week in three years from Q4/2019 to Q4/2022. From the regression result of Tesla, the t-start of the x-variable is 4.13 (>2), indicating that this regression test is significant, however, the coefficients is only 0.016, suggesting that there is only a weak

relation between the stock price growth and the google search volume growth. Similarly, the Nio regression test drawn the same conclusion, with the t-start at 4.130, the coefficients is 0.146. Therefore, in this paper, there is a weak positive relation between public exposure and stock price

7. Stock Valuation

7.1 P/E and P/S Ratio

Price to earnings (P/E) ratio is a standard metric for evaluating the company's stock price and earnings per share (EPS). Generally, the P/E ratio offers an insight into the potential of a stock's growth; the higher the P/E, the higher the expected return for an investor.

Price to sales (P/S) ratio is another method used to understand a company's financial health and prospects for its future growth. The P/S ratio shows how much investors are willing to pay per dollar of sales for a stock, and in general, the lower the P/S, the better the value is (Maverick, 2022).

Tesla and Nio's primary revenue source is automobile sales; therefore, the selection of comparable enterprises is positioned as firms in the automobile industry. In this paper, I choose Toyota, GM, Ford, Mercedes-Benz, Volkswagen, BYD, and XPENG, according to these automobile producers' market share and competitiveness. The enterprises have long produced petroleum vehicles (except for BYD and XPENG). They are entering the new energy industry or are potential competitors of Tesla and Nio.

I selected data from these seven enterprises on March 6, 2023, to conduct a relative valuation of Tesla and Nio.

Table 5. Average P/E and P/S of firms in the automobile industry

Company	P/E	P/S
Toyota	9.21	0.71
GM	6.41	0.36
Ford	-36.3	0.33
Mercedes-Benz	6.34	0.57
Volkswagen	4.74	0.32
BYD	262.3	2.04
XPENG	-6.81	1.80
Tesla	49.2	7.68
Nio	-9.61	2.47
Average	31.72	1.810

Source: Yahoo Finance.

Because the P/E ratio in the automobile industry is highly fluctuating, it is impossible to use the industry's average P/E ratio to conduct an accurate valuation of enterprises. Furthermore, the result shows that the P/E of Tesla and Nio are inconsistent, as Tesla's P/E is highly positive, and Nio's P/E is negative. I decided to use P/S to provide a valuation for Tesla and Nio, as it is more stable among the vehicle production industry (and EV producers) compared to P/E value.

Table 6. Tesla valuation result using P/S ratio

Sales revenue per share ($)	$26.03
Industry average P/S ratio	1.810
Valuation price ($)	$47.11
Market price ($)	$193.81
Conclusion	Overvalued

Source: Conducted by author.

Table 7. Nio valuation result using P/S ratio

Sales revenue per share ($)	$3.99
Industry average P/S ratio	1.810
Valuation price ($)	$7.22
Market price ($)	$9.12
Conclusion	Overvalued

Source: Conducted by author.

7.2 Discounted Cash Flow (DCF)

The Discounted Cash Flow (DCF) is another measure that can be used in valuation as it provides a framework for determining the present value of future cash flows. Several papers have also concluded that DCF is a powerful tool for measuring and managing the value of a company. Koller et al. (2020), in their book 'Valuation: Measuring and Managing the Value of Companies' found that DCF is the most reliable approach for valuing companies, especially for those with stable cash flow, and DCF can be used in conjunction with other valuation methods to provide a comprehensive analysis of a company's value. The book Investment Valuation: Tools and Techniques for Determining the Value of Any Asset" (Damodaran, 2012) also emphasized that DCF is useful when valuing equity, debt, and real estate in different contexts. In this paper, I will also apply the 5-year DCF method to assess whether EV automakers are overvalued.

Table 8. Tesla 5-year discounted cash flow

Ticker: TSLA (NASDAQ)							
Date: 6/3/2023							
Current price: $193.81							
Data Forecast	**22-Dec**	**23-Dec**	**24-Dec**	**25-Dec**	**26-Dec**	**27-Dec**	**Terminal**
Revenue	81462	102046	132286	152814	164509	198455	
% growth	51.40%	25.30%	29.60%	15.50%	7.70%	20.60%	
EBITDA	17439	20540	28740	36948	42183	46016	
% of Revenue	21.40%	20.10%	21.70%	24.20%	25.60%	23.20%	
CapEx		7508	8501	8645	9735	10788	10788
% of revenue		7.40%	6.40%	5.70%	5.90%	5.40%	5.40%
D&A		6669	7944	10153	8808	2884	10249
% of revenue		6.50%	6.00%	6.60%	5.40%	1.50%	
Terminal Depreciation of CapEx							95.00%
Tax rate assumption							15.00%
Valuation		**Bear Market**		**Base Market**		**Bull Market**	
Selected Perpetuity Growth Rate	31551	7.50%		8.00%		8.50%	
Terminal value		753730		973588		1369334	
Implied Exit Revenue Multiple	198455	3.8x		4.9x		6.9x	
Implied Exit EBITDA Multiple	46016	16.4x		21.2x		29.8x	
Company LTM EBITDA Multiple		35.3x		35.3x		35.3x	
Benchmark LTM EBITDA Multiple		-5.8x		-1.3x		19.7x	
Historical LTM EBITDA Multiple		-191.8x		-6.5x		-3.7x	
CAPM		$= Rf + Beta * ERP = 3.41\% + 1.20 * 4.78\% = 9.15\%$					
WACC		$= Cost\ of\ equity * Equity\ weight + Cost\ of\ debt * debt\ wegight$					
		$= 9.15\% * 99.73\% + 1.00\% * 0.27\% = 9.13\%$					
Selected discounted rate		10.15%					
Fair value		$45.29		$91.50		$283.14	
Implied upside/Downside		-76.6%		-52.8%		-46.1%	

Table 9. Nio 5-year discounted cash flow

Ticker: NIO (NYSE)							
Date: 6/3/2023							
Current price: $9.31							
Data Forecast	**22-Dec**	**23-Dec**	**24-Dec**	**25-Dec**	**26-Dec**	**27-Dec**	**Terminal**
Revenue	49269	51000	78868	125116	152273	179694	
% growth	36.30%	3.50%	54.60%	58.60%	21.70%	18.00%	
EBITDA	-13933	-9733	-8996	593	7838	16668	
% of revenue	-28.30%	-19.10%	-11.40%	0.50%	5.10%	9.30%	
CapEx		4500	4716	3944	4470	4909	4909
% of revenue		8.80%	6.00%	3.20%	2.90%	2.70%	2.70%
D&A		6669	7944	10153	8808	2884	10249
% of revenue		6.50%	6.00%	6.60%	5.40%	1.50%	
Terminal Depreciation of CapEx							95.00%
Tax rate assumption							38.00%

Valuation		Bear Market	Base Market	Bull Market
Selected Perpetuity Growth Rate	10351	5.25%	5.75%	6.25%
Terminal value		124511	141245	162937
Implied Exit Revenue Multiple	179694	0.7x	0.8x	0.9x
Implied Exit EBITDA Multiple	16668	7.5x	8.5x	9.8x
Company LTM EBITDA Multiple		-6.5x	-6.5x	-6.5x
Benchmark LTM EBITDA Multiple		-47.5x	3.0x	35.3x
Historical LTM EBITDA Multiple		-191.8x	-6.5x	-3.7x
Cost of equity (CAPM)		$= \text{Rf} + \text{Beta} * \text{ERP} = 2.86\% + 1.20 * 4.78\% = 8.59\%$		
WACC		$= \text{Cost of equity} * \text{Equity weight} + \text{Cost of debt} * \text{debt wegight}$ $= 8.59\% * 49.86\% + 5.00\% * 50.14\% = 6.79\%$		
Selected discounted rate		9.10%	7.69%	6.13%
Fair value		**$9.34**	**$11.19**	**$21.48**
Implied upside/Downside		**0.3%**	**20.2%**	**130.7%**

7.3 Discussion

In section 7.1, when the P/S ratio is applied to calculate the reasonable valuation of Tesla and Nio, with an average P/S of the market is 1.810, the valuation for Tesla was $47.11 and for Nio was $7.22, meaning that both two EV automakers are overvalued. However, when DCF is applied in section 7.2, the valuation of Tesla was $45.29 - $283.14 in three cases (Conservative, Base, and Optimistic), meaning that the stock is overvalued in all cases calculated. In the case of Nio, the result was different from the P/S method, as the fair value ranged from $9.34 to $21.48, representing an undervalue compared to the present price ($9.31).

From the valuation methods, Tesla and Nio's share prices are overvalued. As the DCF model pointed out, the overvaluation is less significant than the P/S ratio method illustrated. However, as DCF recommended, Nio still has potential to continue its uptrend in the following years. However, the P/S ratio and DCF are only two of several valuation methods; therefore, to make an investment decision, one recommends that investors apply a combination of valuation methods (apart from those mentioned earlier) with up-to-date data to produce the most accurate valuation.

8. Conclusion

This paper has shown that regardless of lower sales revenue and the financial result compared to traditional automakers, there are reasonable factors that have contributed to the growth of EV automakers via two case studies: Tesla and Nio.

Using the event study method, it is first shown that EV promotion policies by the government lead to positive growth in the stock price in the short term (CAR > 1%). From a geographical aspect, US government policies lead to higher volatility than China and the EU, which might be explained by the fact that the two companies investigated are listed on US Stock Exchange. In the list of events presented, an analogy event appears, which is event (3). The potential explanation is that Tesla and Nio have already allocated infrastructure investment and this announcement leads to reverse reaction of the investors. Another reason for the stock growth of EV automakers is the expectation of future growth, and the market value of EVs has a higher expected CAGR than the market value of the overall industry. This has been supported by the fact that consulting reports (from McKinsey, PWC, Goldman Sachs, etc.) all provide an optimistic view of the future of electric vehicles. However, the R&D expense does not explain the growth motivation of EV producers' share price, as the regression test indicates no direct relationship between R&D expense/Revenue and Share price in a quarter-over-quarter measurement. The Google search volume volatility is not the cause of growing and volatile stock prices of both Tesla and Nuo as the regression test between Google search volume change (%) and share price change (%) on week-over-week basis indicates that there is no relationship.

Regarding the valuation, from the P/S ratio method, both Tesla and Nio are currently overvalued, as the reasonable price for Tesla and Nio is $47.11 and $7.22, respectively. The DCF provides overvalued conclusion for Tesla but undervalued for Nio, as the valuation for Tesla ranges from $45.19 to $283.14 for Tesla and $9.34 to $21.48 for Nio. A limitation of the valuation presented is that there is a significant difference in the result of the two methods presented, arising from the difference in financial indexes taken. As a result, it is suggested that investors should use this valuation as a reference only, and investors need to present their valuation using updated financial data.

From the conclusion drawn above, it is possible to say that the expectation of a supernormal growth market for

electric vehicles is the reason for the growth in stock price, as two contributing factors are promotion policy by the government and a positive market outlook. Further research is required to determine the accurate extent to which each factor influences the share price and whether any other factors might explain the growth of EV producers' stock.

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Notes

Note 1. List of reports used to summarize data.

- McKinsey & Company. (2021). The future of mobility is at our doorstep.
- PwC. (2021). Digital auto report 21/22.
- PwC. (2021). COVID-19: Impact on the automotive industry.
- Goldman Sachs. (2023). Electric vehicles are forecast to be half of global car sales by 2035.

Note 2. Several reports from Bloomberg, Forbes, Markets and Markets were also used to evaluate the relationship between Internal combustion vehicles and electric vehicle growth. The same result was witnessed

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