

# Electric Vehicle Investment Analysis Based on Indicators: Evidence from NIO, BYD and, TSLA

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**Abstract.** The electric vehicle industry has been operated for plenty of decades, but it has gained very little popularity worldwide. However, research has shown that several countries are gaining interest in this industry. Therefore, electric vehicles will likely gain popularity within the next decade. Investors are interested in this industry since it is unique and has yet to be explored fully. It is necessary for potential investors to conduct electric vehicle investment analysis, hence they get to make informed decisions. Indicators are the best metrics to carry out investment analysis, which give insight into the behavior of finances, thus determining whether the investment is favorable. This paper is a case study of three automotive companies (i.e., NIO, BYD and TESLA) that have ventured into electric vehicle production. Conducting investment analysis concerning electric vehicles is necessary before venturing into the business. This study encourages evaluating a firm and, thus, predicting its future performance. Investment analysis enables one to reduce losses and increase returns by making informed decisions. A general financial strategy can be obtained from conducting an investment analysis. Data obtained from the record will be utilized to calculate various indicators. The corresponding results are critically analyzed and discussed to explain all the factors that should be considered before investing. These results also capture areas on which research still needs to be carried out, which shed light on guiding further exploration in this field.

**Keywords:** Investment Analysis, Indicators, Electric Vehicles.

## 1. Introduction

Electric vehicles are fast becoming the future of transportation. They are relatively effective, much quieter since they do not have moving parts, produce no emissions (generate little pollution) and rapidly become affordable [1]. Despite being in existence for over a century, electric vehicles began to gain the attention of many just recently [2]. Electric vehicles are powered by batteries which store electricity. The electricity is sent to the vehicle's motor when the driver presses the accelerator, which then powers the vehicle. Electric vehicle company is currently a preferred investment opportunity. The industry still has a wide room for growth which is a good sign for potential investors [3]. Electric vehicles have yet to be adopted by many countries across the world. Moreover, researchers have evaluated that mass adoption is not becoming a reality any time soon [4]. It makes the industry unique and suitable for investment. Several research surveys have revealed that the widespread of electric vehicles will be achieved around or after 2030. This is a positive idea since investors can still conduct numerous research regarding factors such as; production, supply, and consumer preference and still have the company up and running by the stipulated time. Additionally, the threats to entry into this industry are low. Thus, anyone (individual or group) with good ideas and sufficient capital can invest.

Advancement of technology and the increased concern for climate change are accelerating the popularity of electric vehicles. Electric vehicles are considered a much more suitable and cleaner transportation option than gasoline-powered ones [5]. The popularity and use of gasoline-powered vehicles will likely change due to the increased need to reduce climate hazards. Therefore, there is a high potential for disruption in the automotive industry. Electric vehicles are considered more efficient, users and investors will be focused in that direction. Introducing electric vehicles will change the automotive industry, from manufacturing vehicles to operating gas stations [6]. Such changes offer more investment opportunities.

The electric vehicle industry collaborates with other companies to enhance smooth running. These companies aid in the operation, production and distribution of the industry's products. The main

sectors in the electric vehicle market include technology companies, car manufacturers and utility companies [7]. Car manufacturers are heavily investing in electric vehicles, motivated by government initiatives and consumer demand, and possess a financial capability to affect the market. Technology companies have a key role in developing innovative technologies concerning electric vehicles. Utility companies aid in developing infrastructure that would enhance the efficient operation of electric vehicles.

There is a need to critically investigate indicators before investing in the electric vehicle industry. An effective way to achieve this is to conduct an electric vehicle investment analysis based on indicators. Investment analysis is a collection of methods for evaluating industry sectors, and economic trends, evaluating investments [8]. It involves investigating past returns to forecast future performance, evaluating securities to determine their risks, and selecting an investment type that best suits the investor's needs. The main aim of investment analysis is to evaluate how a particular investment is likely to perform and its suitability to the specific investor. The main considerations when conducting such analysis are the role of the investment in the portfolio, favorable entry price and expected duration for holding the investment [9]. Indicators for investment are the elements used to help determine whether a particular investment is suitable (Baumohl). Indicators used to determine investment are Return on Investment (ROI), Return on Assets (ROA), Return on Equity (ROE), business risk, leverage, debt-to-equity ratio, expected cost of Equity, capital and marginal corporate tax rate. These components help determine how much interest the investment will earn, possible financial risks the investment may encounter, projected tax charges on the investment and other financial factors.

This paper will study investment analysis based on indicators with evidence from three firms, i.e., NIO, BYD and TSLA. These firms are promoting the production of electric vehicles to reduce transportation costs and protect the climate. Thus, they are a perfect case study for this research. Independent investment analysis based on indicators will be conducted for each firm. Data used to calculate these indicators will be obtained from records. Results obtained from these calculations (indicators) will be discussed critically to gain insight into potential investors. This study will be helpful not only to investors interested in the mentioned firms but also to potential investors for other electric vehicle companies. Several investors are in the fast-growing electric vehicles industry. A good number of firms are already producing electric-powered automobiles. However, the demand is projected to increase in the coming years. Therefore, research on an exact firm to invest on are is encouraged. Electric vehicle investment analysis is important for the following reasons. First of all, investment analysis evaluates an industry and predicts its future performance, thus determining its suitability to a particular investor. Besides, it enables a potential investor to create a general financial strategy. In addition, it helps one to make informed decisions that can increase potential return and minimize the risk of loss.

## 2. Literature Review

Investment analysis is a component of the broader financial analysis. Such skills are important to a wide range of individuals, including creditors, regulators, and investors. Financial analysis is more important within the company, but investment analysis is more important to a potential investor [10]. An investor should have an idea of the future development of a company. The baseline is to find out how the company operates now, diagnose the company's weaknesses and strengths, and anticipate the firm's future financial status [11]. Foreigners mainly used the DuPont model to analyze the finances of manufacturing industries [12]. This model is written as  $ROE = ROA \times FL = NI/TA \times TA/Eq$ , where ROE is the Return on Equity, ROA is the Return on Assets, FL is Financial Leverage, NI is Net Income, TA denotes Total Assets, and Eq implies Equity. Several researchers noted that taking into consideration each of the two return ratios in the model would highlight the factors that exert a negative or positive impact on Return on Assets [13].

Annual Debt Service Coverage Ratio is the measure that calculates cash flow for a duration in relation to loan interest amount and principal payable for the same duration [14]. This ratio ranges on both sides of the measurement scale. However, a minimum value of 1 or greater than 1 indicates that the firm earns enough income to repay its debts. This indicator is important not only to financiers but also investors since it can monitor and evaluate a particular company's financial performance. Many investors who primarily invest in fixed-income securities, are often concerned with inflation. Inflation is the general increase in the prices of commodities and a decrease in the purchasing value of money [15]. Current inflation rates, their strength, and the future state of inflation are key in evaluating interest rates and investing strategies. Several indicators focus on the pressure caused by inflation. The most visible ones are Consumer Price Index and Producer Price Index [16]. Investors would use the latter to predict the upcoming Consumer Price Index. A proven relationship exists between the two indicators. Specifically, if the cost of production increases, a portion of the price will be passed on to the consumers. Other inflation indicators are money supply and growth rates.

Return On Investment (ROI) is a financial indicator used for measuring the profitability of capital (invested capital). The investment decision is crucial, especially to the general company policy, thus the need to evaluate ROI. Investments are ways to secure a company's development in the medium or long term [17]. Investments are considered as resources deployed in order to achieve benefits over time. A company's performance is best assessed by determining profits earned on the assets used. ROI is a good measure of profits obtained from invested capital. ROI is calculated as a ratio between the operating profit obtained after investment and the total investment costs. The result should be a percentage. Therefore, the ratio is multiplied by 100. That is,  $ROI = [Revenue \text{ (after investment)} - Amount \text{ invested} / Amount \text{ invested}] \times 100\%$ . Despite ROI is an easy to calculate indicator, there is a problem associated with it. The problem results from where the value of depreciable assets is considered, either net or gross. The net value of fixed assets has the advantage of being consistent with financial accounting but leads to tampered results which incorrectly reflect the profitability of investments. The distortion of results would lead to the making of wrong decisions. The gross value is disadvantaged because it lacks consistency with financial statements and does not consider the incidence of depreciation. Nevertheless, it allows assets to be replaced with little impact on ROI [18].

Tesla (TSLA) is an American clean energy and automotive industry. Its headquarters is located in Austin, Texas. Tesla was formerly known as Tesla motors after an incorporation by Martin Eberhard and Marc Tarpenning in 2003. Tesla designs and manufactures electric cars, electric trucks, solar panels, battery energy storage, solar roof tiles and other related products and services. Tesla's software is distinguished by its over the air updates, not only on user interface and infotainment, but also on safety-critical features that are hand wired in the car's firmware. Tesla is among one of the world's most valuable companies. It also remains the most valuable automaker in the whole world with a market capitalization of above US\$840 billion [19]. Tesla's subsidiary company is Tesla Energy. Through Tesla Energy, the company is able to develop and has become a major installer of photovoltaic systems in the US.

BYD Company Limited is a publicly listed Chinese manufacturing company. Its headquarters is in Shenzhen, China. This company was founded by Wang Chuanfu in 1995. BYD Company Limited has two main subsidiaries namely; BYD automotive and BYD electronic. The company manufactures buses, solar panels, rechargeable batteries, automobiles, electric bicycles and trucks. BYD Company recorded quick growth in a period of ten years and became China's largest manufacturer of all types of rechargeable batteries [20]. BYD recently made public its intention of ending production of combustion vehicle engines and focusing on electric vehicles only. BYD did not intend to be a car company since its onset [4]. However, similar to everything happens in China, BYD scaled up and rose its value chain. The company would reverse-engineer other vehicle brands, i.e., it improved and began to innovate its own. Despite huge progress, BYD still faces challenges which include: bad cost control, internalization failure, the risk of earning quality problems and uncertainty of new business.

NIO automobile company is an electric car maker in China, it was founded by William Li in the year 2014. The company's headquarters is in Shanghai, China. NIO is a global automobile

manufacturer; it designs and develops electric powered vehicles. After the launch of NIO, several companies invested in the company, including Tencent, Temasek, Lenovo, Sequoia and TPG. NIO launched its first car, EP9 electric hyper car, on the same day that the company was launched. Among Chinese companies, NIO has shown an unusual strategy. It is not obsessed with manufacturing but instead it focuses on innovating business model for the high-end segment. NIO has expanded to international markets and its selling a lifestyle. NIO has built a functional network of battery swap stations, 700 in number, which covers many kilometers of China's expressways [21]. This is a step ahead of TSLA which tried deploying battery swapping in large scale but has never succeeded. It instead relied on its supercharger network.

### **3. Data & Method**

#### **3.1. Data**

Investors are always advised to make informed decisions before committing to a particular business venture. They need to comprehend the various characteristics of stocks and bond and also the companies that issue them. This understanding can be achieved by critically evaluating the company's earnings. However, a great challenge is to retrieve the data to be used for such research. Data of different companies' stocks and financials can be obtained by corporate filings, research reports, direct from company, websites or Electronic Digital Gathering Analysis and Retrieval system [22]. Firstly, corporate filings provide potential investors with information entailing companies' financial status, previous performance, and prospects. It is key in judging whether certain stocks are smart investments. When intending to buy stocks, these fillings go through a company's balance sheet to determine its financial health and outlook. Secondly, currently almost all companies have websites through which they provide information about themselves. Investors can look for information on annual reports, stock information and financial statements from the company's website [23, 24]. Other than the companies' website, many other websites offer information for free or on a subscription basis. These sites are much beneficial since they offer concise information. An example is Yahoo Finance. Lastly, research reports can also provide meaningful information to an investor who doesn't intend to break down the numbers by him/herself. These reports offer investors a professional examination of the company's condition, both current and future.

#### **3.2. Criteria for selection**

Reviewing the numerous data obtained from the sources mentioned above to determine which company is suitable for their portfolio can be laborious to investors. A developed criteria for evaluating stocks would ease the task [25]. The best data to be collected by investors should align towards these considerations: First, good current and projected profitability, data obtained for purposes of conducting an investment analysis should be able to paint a clear picture of a company's current finances and how much profit its likely to make in the short and long term. Investors should consider stability and trends of earnings. Second, conservative capital structure refers to how a uses both Equity and debt to fund its business operations. Third, favorable asset utilization is the ratio of the amount of revenue earned for every dollar of a company's asset. It is a measure of efficiency over time. Fourth, earnings momentum; an investor should look out for the acceleration or slowing of earnings growth from one period to the next. It is a better measure for determining where a company is compared to recent or current earnings. Lastly, intrinsic value is determined by using complex relative and complex absolute valuation models. These values outline a stock's real value. Investors should consider stocks whose market value is less than intrinsic value since this can suggest eventual growth in price.

### 3.3. Indicators

Indicators are metrics or values that companies use to measure, track and analyze the financial status of the company. These factors are crucial to investors, since they aid in decision making. The indicators that are mainly used as following:

- Gross Profit Margin, which is a profitability ratio, it measures the percentage of revenue left after the cost of goods sold is subtracted. It is a measure of profitability without accounting for overheads. The expression is  $\text{Gross Profit Margin} = (\text{Revenue} - \text{Cost of Sales}) / \text{Revenue}$ .
- Net Profit Margin, a measure of profitability that account for all costs of business, includes operating expenses, cost of goods sold, taxes and interest. Net Profit Margin is computed as:  $\text{Net Profit Margin} = \text{Net Profit} / \text{Revenue}$ .
- Working capital is the measure of a business's available operational liquidity, which is used to fund everyday operations with expression  $\text{Working Capital} = \text{Current Assets} - \text{Current Liabilities}$ .
- A quick ratio is a liquidity ratio that measures the business's ability to cater for short term needs. It uses only highly liquid current assets, i.e., assets that are easy to turn into cash, which can be obtained as  $\text{Quick Ratio} = (\text{Current Assets} - \text{Inventory}) / \text{Current Liabilities}$ .
- Financial leverage (equity multiplier) is the use of debt to buy assets. An increase in debt increases the multiplier from one, thus, increasing the risk of that particular business with expression of  $\text{Leverage} = \text{Total Assets} / \text{Total Equity}$ .
- Debt-to-equity Ratio is a ratio that measures how much a company finances itself using Equity versus debt. This ratio reflects the ability of shareholder equity to cater for all debt in the event of a decline in business with the formula as  $\text{Debt to Equity Ratio} = \text{Total Debt} / \text{Total Equity}$ .
- Total Asset Turnover is an efficiency ratio that determines how effectively a company uses its assets to produce revenue. A higher turnover ratio implies better performance of the company. The expression is  $\text{Total Asset Turnover} = \text{Revenue} / (\text{Beginning Total Assets} + \text{Ending Total Assets} / 2)$ .
- ROE is a profitability ratio that indicates how well a business can utilize investors' Equity to earn profit. The formula is  $\text{ROE} = \text{Net Profit} / (\text{Beginning Equity} + \text{Ending Equity}) / 2$ .
- ROA is also a profitability ratio, which indicates how well the company manages its available assets and resources to acquire higher profits. The expression is  $\text{ROA} = \text{Net Profit} / (\text{Beginning Total Assets} + \text{Ending Total Assets}) / 2$ . A higher ROE and ROA indicates that a company is performing well hence, suitable for investors.

**Table 1.** Data summary of the three companies

	NIO	BYD	TSLA
Market value of equity	131.47	484.32	7107.89
Market value of debt	28.47	28.98	110.08
Total assets	159.94	513.30	7217.96
Equity beta	0.61	1.37	2.02
Marginal corporate tax rate	25.00%	25.00%	18.00%
rf	2.13%	2.13%	2.13%
rm	10.00%	10.00%	10.00%
interest of debt	0.20	0.91	3.71

## 4. Results & Discussion

This section covers calculations of indicators for the three case study companies, interpretation and discussions of the results. A comprehensive comparison will also be made to clearly distinguish the three firms. Suggestions for investments will be made based on the results. The data was collected (independently for each of the three companies) as summarized in Table. 1. The main indicators that will be used to conduct investment analysis for the three electric vehicle companies include leverage,

debt-to-equity ratio, expected cost of equity capital (rE), Expected cost of debt capital (rD), Weighted average cost of capital (WACC), all-equity expected return on assets (rA) also known as ROA and, Business risk ( $\beta_A$ ).

#### 4.1. Tesla

The results for Tesla are summarized in Table. 2. Tesla recorded leverage /equity multiplier as 1.53%. An increase in debt would increase this value thus implying increased business risk. However, the value is within an acceptable margin making the firm suitable for investment. Tesla's debt to equity ratio is 1.55 indicating that it uses more debt than equity to finance its operations. Investors looking to invest in Tesla should ensure their investment value is above 18%, the company's expected cost of debt. Tesla pays an interest of 3.37% for its debts. The company's average rate of return is 17.77%, this is the possible percentage of return that an investor at Tesla can earn. The value of WACC is not different from that of return on assets (ROA) since they have the same implication. The company recorded a business risk rate of 2%, this shows that the company is unlikely to encounter losses.

**Table 2.** Results summary of Tesla

leverage	1.53%
debt-to-equity ratio	1.55%
Expected cost of equity capital (rE)	18.00%
Expected cost of debt capital (rD)	3.37%
Weighted average cost of capital (WACC)	17.77%
all-equity expected return on assets (rA)	17.82%
Business risk ( $\beta_A$ )	1.99

#### 4.2. NIO

NIO recorded equity multiplier as 17.8%, implying that the company spends 18% of debts to acquire assets. This value a slightly high thus investors should investigate further. Investors looking to invest in NIO should ensure their investment value is above 7%, since the company's expected cost of debt is 6.93%. NIO has recorded a debt-to-equity ratio of 21.66%, this indicates that it uses more debt than equity to finance its business operations. NIO pays an interest of 0.7% for its debts. The debt repayment rate is low thus not much effect to the company. The company's average rate of return on assets is 6% (almost similar when weighted since WACC is also equivalent to 6%). This value denotes the possible percentage of return that an investor at NIO can earn. NIO recorded a business risk rate of 0.5%, this value is extremely low. It is probably because NIO is highly innovative.

**Table 3.** Results summary of Nio

leverage	17.80%
debt-to-equity ratio	21.66%
Expected cost of equity capital (rE)	6.93%
Expected cost of debt capital (rD)	0.70%
Weighted average cost of capital (WACC)	5.79%
all-equity expected return on assets (rA)	6.06%
Business risk ( $\beta_A$ )	0.50

#### 4.3. BYD

BYD recorded leverage as 5.53%. An increase in debt would increase this value thus implying increased business risk. This value is slightly high thus the need for more insightful analysis. BYD's debt to equity ratio is 5.98% indicating that it uses more debt than equity to finance its operations. Individuals interested in investing in Tesla should ensure their investment value is above 13%. BYD pays an interest of 3.15% for its debts. The company's average rate of return, that is, the possible percentage of return that an investor at BYD can earn is 12.47%. This value is proportional to the risk

of investment. The company recorded a business risk rate of 1.31%, this shows that the company is unlikely to encounter serious losses or a possible failure.

**Table 4.** Results summary of BYD

leverage	5.65%
debt-to-equity ratio	5.98%
Expected cost of equity capital (rE)	12.88%
Expected cost of debt capital (rD)	3.15%
Weighted average cost of capital (WACC)	12.29%
all-equity expected return on assets (rA)	12.47%
Business risk ( $\beta_A$ )	1.31

#### 4.4. Comparison & Suggestions

Among the three automotive companies, Tesla would be rated the best performing company. The rate for Tesla, that is, leverage, debt to equity ratio, expected cost of debt capital and business risk are relatively low. In addition, cost of equity and return on assets are much higher compared to the other two companies. These results would have Tesla being at the top of the list, as a suitable firm for investment. Even though NIO's business risk rate is low, the company's leverage, expected cost of debt and debt to equity ratio is high. The company has also recorded the lowest return on asset rate. BYD, on the other hand, have recorded relatively fair rates. The rates are not as low as those of NIO but also not desirable as those recorded by Tesla. All three companies are suitable for investment depending on the individual's or corporate's preference and investment capability. None of the companies have high business risk rates. An investor with high investment capability, that is, one who can invest in a lot of stock, should consider Tesla. This is because Tesla offers high returns rates that are proportional to the high risk of investment. Those interested in investing in average number of stocks which are associated with reduced risk should consider either BYD or NIO. However, the bottom-line idea is that a potential should seek or engage in a thorough investment analysis before deciding to invest in any of the three case study companies.

Among the three case study firms, BYD and NIO are the electric vehicle manufacturing companies located in China. BYD operates in more than 50 countries in the entire world while NIO provides services to over 25 regions and countries across the world. BYD uses more borrowed capital (17.8%) to increase its returns while NIO uses 5.98% of debt to finance its operations. BYD's debt to equity ratio is 5.98% which is less than that of NIO (21.66%), this shows that BYD records less debt on its balance sheet. BYD has the higher return rate on investment between the two companies; NIO's cost of equity capital is 6.93% while that of BYD is 12.88%. However, the effective interest rate that BYD pays on its debts is much higher than that of NIO. The Return on Assets, i.e., the profitability of the company based on its total assets, is higher than that of NIO. Even though NIO's profitability rates are lower than those of BYD, it does not show that NIO is not suitable for investment. The rates are proportional to the company's total assets, debts, and shares. NIO has a lower business risk therefore it attracts low risk investment, that is, much less equity. BYD on the other hand, has a higher business risk (1.31). Thus, it attracts high risk investment. Both companies have sustainable financial rates and thus they are suitable for investment. A potential investor should decide on the highest possible value of investment and the risk he or she is willing to take, then determine which electric vehicle company to invest in.

## 5. Conclusion

In conclusion, it is necessary to conduct investment analysis based on specific indicators before making an investment decision. Sampling three or more companies in the preferred sector, computing indicators for all of them independently and making comparisons, makes the decision-making process much easier. Looking at a company's current and past financial health status is not sufficient information to be considered before making an investment. Investment analysis can be arduous since

huge datasets are involved and there is need to conduct rigorous calculations. Most potential investors lack the knowledge of where to source accurate company financial data and the criteria to be used for data collection, leave along conducting a proper investment analysis based on appropriate indicators. This study has highlighted reliable sources of financial data for different companies. These sites store past records and updates their records frequently, mostly daily, making it suitable for one to analyze both past and current trends. These trends, once established can also be used to forecast the future trends. Despite all the updates regarding to financial data, getting hold of precise data to be used for calculating investment indicators is not easy. One is tasked with having to go through turns of data to get values that give specific implications. This problem was one limitation to this research. Another limitation to this study was the inability to identify exactly which financial indicators are suitable for investment in manufacturing companies (specifically electric vehicle manufacturing). There are several financial indicators but they are not specified for exact sectors. Therefore, one must learn about a good number of them, then figure out (personal judgment) the most suitable one to apply in specific investment analysis. A potential investor who lacks deep financial knowledge would have a hard time working this out and would be forced to hire financial analyst to do an investment analysis for him or her.

The electric vehicle industry has not yet become extremely competitive though its popularity is envisioned in within the next 10 years. This is sufficient period for more research to be conducted regarding production, sales, and operation of the electric vehicles. Research should be done on these areas and be made to the general public so that those interested in investing to do so in good time and to educate on the benefits of electric vehicles as compared to gasoline vehicles. Customer preference of one product over another and acceptance of the new product highly influences businesses. More studies should focus on this aspect with regards to electric vehicles. Overall, these results offer a guideline for investment analysis based on indicators.

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