Journal of Management and Economic Sciences Prospects | Volume: 07 / N°: 02 (2023), p 248-266

Application of the Altman z-score model to analyze SONATRACH's financial performance: highlighting the impact of oil prices volatility

Maroua Lahmar [*1], Benabbou Senouci [2]
[1] Oran Graduate School of Economics, LAREEM, Algeria,
maroua.lahmar94@gmail.com
[2] Oran Graduate School of Economics, LAREEM, Algeria,
senouci.ben@gmail.com

Received: 07/10/2023 ***Accepted: 24/01/2024*** ***Published: 27/01/2024***

Abstract

This research analyzes how fluctuations in oil prices impacted SONATRACH's financial health from 2016 to 2021 using Altman's Z-score model. The company maintained its situation in the gray zone even when the oil price dramatically decreased in 2016 showing a robust attitude of the firm. However, during the peak of the unexpected COVID-19 crisis, the oil price fell below $20, pushing the firm into the distress zone. Nevertheless, this distress situation did not persist for long, by 2021, it returned to the gray zone, indicating a potential improvement in its financial strength.

Keywords: Financial performance; Oil prices; Z-score; SONATRACH.
Jel Classification Codes: Q41

1. INTRODUCTION

Fluctuations in the price of oil can exert substantial effects on economies heavily reliant on oil-generated revenues. Over the past six decades, there have been pronounced oscillations in oil and other commodity prices. The initial surge in prices can be attributed to the accumulation of raw materials during the Korean War in 1950-51. Subsequently, the second surge, observed during 1973-74, was instigated by erratic crop yields and mismanagement of oil supplies by OPEC, resulting in a tripling of oil prices. The current ongoing third surge, commencing in 2004, is primarily propelled by the sustained and robust economic expansion of China and India, accompanied by their escalating demand for

* ***Corresponding author***:.

raw materials, notably including oil (Askari & Krichene, 2008). In the later part of 2008, the price of oil experienced a sharp increase, reaching a pinnacle of $147 per barrel. However, this peak was short-lived, and shortly thereafter, the price plummeted significantly to $40 per barrel. This abrupt decline led to significant disruptions for economies and companies across the board (Alquist & Kilian, 2010).

Oil prices fell below the $50 threshold as the year 2015 commenced due to an oversupply of oil, primarily stemming from the extensive production of shale oil in the United States, despite a consistent global increase in oil demand. As a response to this challenging market condition and with the aim of safeguarding its market share, Saudi Arabia decided to maintain the production levels within the Organization of the Petroleum Exporting Countries (OPEC) (Hui, Lo , Cheung, & Wong, 2020). This strategic move was intended to compel American shale gas producers to reduce their own production, leading to a contentious standoff in the oil market (Bagirov & Mateus, Oil prices, stock markets and firm performance: Evidence from Europe., 2019)**.** The consequence of these events was evident when the Brent crude oil price dramatically dropped below $30 per barrel in January 2016, reaching its lowest level since 2003. This sharp decline in oil prices posed significant hardships for various oil-producing nations, notably impacting countries like Venezuela, Algeria, and Russia.

This observation led OPEC to modify its strategy in order to expedite market rebalancing. This objective was achieved through the OPEC/non-OPEC agreement reached in November 2016, which was subsequently renewed twice in 2017 (in May and November), and extended throughout the entirety of 2018. The agreement set a reduction in oil supply by 1.8 million barrels per day (Mb/d), with OPEC members accounting for 1.2 Mb/d and non-OPEC countries, including Russia and Mexico, contributing 0.6 Mb/d (Gil-Alana, Yadollah , & Nazari , 2020).

The increase in oil demand and the supply management efforts by OPEC resulted in a significant decline in excess stocks held by OECD countries. These stocks were generally halved between the second quarter of 2016 and the third quarter of 2017. Thus, from this perspective, OPEC's strategy can be considered a success.

The Covid-19 virus pandemic represented a significant disruption, causing a sharp decline in global economic growth starting from March 2020 (Gadi & Debech, 2021). At the peak of the crisis, by the end of April,

the Brent crude oil price plummeted from a level of 50 dollars to below 20 dollars, a value unseen in the past two decades. Subsequently, from June 2020 onwards, the price partially recovered to a range of 40-45 dollars.

The volatile fluctuations in oil prices were influenced by a multitude of factors. These encompassed the quality and geographical origin of crude oil, production expenses, governmental regulations, market anticipations, geopolitical risks and the dynamics of supply and demand (Su, Khan, Tao, & Nicoleta-Claudia, 2019). The interplay of these elements played a pivotal role in shaping the oscillations observed in oil prices over the course of time.

Additionally, external costs such as greenhouse gas emissions, energy transition policies and environmental concerns can also impact oil price formation (Ilic & Ponomarenko, 2021). That's why oil and gas sector is characterized by significant risks, substantial investments, and the possibility of substantial returns (Misund, Osmundsen, & Sikveland, 2015). Given that making money is a primary objective for any business (Issor, 2018), the oil and gas industry serves as a fascinating example, with substantial financial transactions taking place within its projects. In order to that, it is essential to note that the majority of economies and companies especially oil and gas companies have been impacted in some manner by oil prices fluctuations (Putra, Lahindah, & Rismadi, 2013), making it inappropriate to adopt such a simplistic stance (Hsiao, et al., 2019).The persistent and growing global demand for oil has led to both demand and supply shocks. These fluctuations in supply have acted as catalysts for oil price volatility, posing challenges in effectively managing such fluctuations over extended periods. As the industry plays a crucial role in meeting energy demands, it becomes critical to develop comprehensive and multifaceted performance evaluation methods that account for these complex dynamics (Bilal, Mohammed, & Ali, 2021)**.** Such approaches will provide better insights into the industry's resilience and ability to navigate uncertainties arising from demand-supply imbalances and their associated price fluctuations (Dayanandan & Donker, 2011). In addition, the measurement of performance has fundamental idea that remains unchanged in all theories which is achieving strong performance and financial sustainability. Therefore, environmental requirements and social responsibility cannot override company's sustainability objectives (Brewer & Walker, 2010)

1.1 Research problem

In light of the widespread consequences of oil price fluctuations driven by geopolitical events, unforeseen crises on oil and gas companies' financial health and global economies (Yu, Guo, & Chang, 2022), a comprehensive study investigating oil prices volatility specific impacts on the financial well-being of Algeria's key player, "SONATRACH" which operates in this unstable environment, becomes imperative. Our research question will be: "How does the volatility of oil prices affect the financial performance of SONATRACH?"

1.2 Hypothesis

H_0: There is a relationship between the volatility of oil prices and the financial performance of SONATRACH.

H_1: In the case where oil prices are low, SONATRACH has been able to maintain its financial performance.

1.3 Methodology

To confirm or reject our hypotheses, we will use the Altman model over a period of 6 years (2016-2021).

2. Literature review

In this context, we will consider two crucial aspects. The first one will focus on explaining the impact of oil price volatility on the financial health of oil and gas companies. The second aspect will revolve around the utilization of the Altman model to conduct this analysis.

2.1 Impact of Oil Price on financial Performance

In fact, many researches tried to explain and studied the impact of oil prices' volatility on firms' financial health (including oil and gas companies).

Starting with Hamilton (1983) whom conducted a pioneering study that investigated the influence of crude oil prices on the US recession. Following this, subsequent studies explored how changes in oil prices affect various macroeconomic variables. These research efforts delved into the interplay between macroeconomic factors, oil prices, and their effects on companies' operational costs and revenues (Hamilton, 1983).

Janor et al. (2013) utilized GARCH and EGARCH models to reach the conclusion that oil price volatility had a noteworthy impact on firms during the period spanning from January 1986 to December 2011 (Janor, Abdul-Rahman, Housseinidoust, & Abdul Rahim, 2013).

In a recent study conducted by Nguyen et al. (2020), the researchers

investigated the impact of oil price and exchange rate on the two Vietnamese stock market indices. The findings of the study revealed that oil price had a significant positive effect on both Vietnamese stock market indices (Nguyen, Nguyen, & Nguyen, 2020).

2.2 Altman's Z-score model

The origins of bankruptcy prediction research can be traced back to the 1930s, where early studies explored the application of ratio analysis techniques to forecast future bankruptcy. Subsequent studies until the mid-1960s primarily centered around univariate techniques (Almamy, Aston, & Ngwa, 2016). Bankruptcy models play a crucial role in evaluating the financial stability of companies and are frequently employed by scholars. Among these models, the multivariate technique for predicting failure, pioneered by Altman, Edward in 1968, has gained considerable popularity and remains widely referenced in the current literature. These models provide meaningful measures of financial distress, enabling comprehensive assessments of a company's financial health (Lahmar & Senouci, 2022). Altman in ten years started in 1983 has proposed that the management of distressed firms can utilize the Z-Score model as a guide to a financial turnaround. Many other studies used this model or its update until these days such as:

- In his 2012 paper, Anjum discussed the evolutionary modifications made to the Altman Z-score model between 1968 and 1993. After exploring various changes, he specifically focused on business failure. Ultimately, Anjum concluded that the Altman Z-score model can effectively be employed in the contemporary economy to forecast bankruptcy occurrences two to three years prior to their official disclosure (Anjum, 2012).
- Apoorva et Sneha Prasad (2019), research paper explored the application of Altman Z score on seven companies listed on the Bombay stock exchange. At the end he concluded that Altman Z can be used by the stakeholders of the company in order to protect their financial interest (Apoorva, 2019).
- Dhara J (2019), tries to study the prediction power of Altman Z score model to predict the Bankruptcy of Reliance communication, which has filed for bankruptcy in the month of February 2019 (Joshi, 2019).
- Thanh Tung D and al (2019), their research findings after the application of Altman Z-score showed that not only financial factors affect the bankruptcy risk of companies, but even the non-financial factors have

an important impact (Thanh Tung & Thi Hoang Phung, 2019).

In fact, Altman's Z score developed in 1967 makes it easy to answer the question, "Is the company likely to go bankrupt?" by forecasting a company's failure from a number of ratios (Thanh Tung & Thi Hoang Phung, 2019). Its advantage is simplicity, at the end of the analysis we will be able to answer yes or no. Indeed, the equation of the model is as follows (Ray, 2011):

$$Z = 1.2X_1 + 1.4X_2 + 3.3X_3 + 0.6X_4 + 1.0X_5$$

With (Joshi, 2019):

- X1= Working Capital / Total Assets;
- X2= Retained earnings / Total Assets;
- X3= EBIT / Total Assets;
- X4= Market value of equity/ total liabilities;
- X5= Sales / Total Assets;

We distinguish several formulas for estimating the Z score depending on the type of company (Joshi, 2019). The Zone of Discriminations for manufacturing companies can be presented as (Altman E. I., Iwanicz-Drozdowska, Laitinen, & Suvas, 2017):

Z > 2.99 "Safe" Zone 1.81 < Z < 2.99 "Gray" Zone

Z < 1.81 "Distress" Zone

3. Data and methods

The study covered the period from 2016 to 2021, as data prior to 2016 was not readily accessible. The necessary data for computing the ratios was sourced from the annual reports. After collecting the data, the ratios for working capital/total assets, retained earnings/total assets, earnings before interest and taxes/total assets, market value of equity/book value of debt, and sales/total assets were calculated and analyzed. Subsequently, these calculated ratios were plugged into the equation to determine the z-score.

After calculating the z-score, we will compare its changes with the volatility of Brent prices to analyze the relationship between the z-score and oil prices' evolution.

4. Results and Discussions

4.1 Analysis of X1 = working capital/total assets

The portion of working capital relative to total assets provides investors with insights into the company's underlying operational efficiency. Funds tied up in inventory or owed by customers cannot be utilized to meet the company's obligations. Consequently, an increase in working capital suggests that the company might not be operating at its most efficient. Slow

collection and acquisition processes could indicate underlying issues with the company's operations, which can be better understood by analyzing changes in working capital over several years. A company with low loan rates is one that effectively manages its working capital. Even though cash surpluses may seem positive, they should be invested in ways that generate suitable returns for investors (Cındık & Armutlulu, 2021). In addition, a negative working capital indicates that the company's current liabilities surpass its current assets, as mentioned in the balance sheet. In simpler terms, it means there are more short-term debts than available assets. While negative working capital might be perceived as a significant issue or even a disaster, it can also serve as a means to expand the business using external funds. In other words, a declining working capital ratio over an extended period could be a potential warning sign that requires deeper investigation (Altman E. I., 1968).

Fig.1. Evolution of the ration X1 between 2016-2021

Source: Conducted by the authors

In 2016, the ratio X1 exhibited a negative value (-0.0121927), which pointed towards liquidity challenges. This indicated that the company encountered difficulties in effectively managing its short-term financial obligations during that period. The negative performance of the ratio can be attributed to the substantial collapse in oil prices that began in the summer of 2014. These oil prices fell below the $50 threshold as the year 2015 commenced due to an oversupply of oil, primarily stemming from the extensive production of shale oil in the United States, despite a consistent global increase in oil demand. As a response to this challenging market condition and with the aim of safeguarding its market share, Saudi Arabia decided to maintain the production levels within the Organization of the Petroleum Exporting Countries (OPEC). This strategic move was intended to compel American shale gas producers to reduce their own production,

leading to a contentious standoff in the oil market (Bagirov & Mateus, Oil prices, stock markets and firm performance: Evidence from Europe., 2019).

The consequence of these events was evident when the Brent crude oil price dramatically dropped below $30 per barrel in January 2016, reaching its lowest level since 2003. This sharp decline in oil prices posed significant hardships for various oil-producing nations, notably impacting countries like Venezuela, Algeria, and Russia.

This observation led OPEC to modify its strategy in order to expedite market rebalancing. This objective was achieved through the OPEC/non-OPEC agreement reached in November 2016, which was subsequently renewed twice in 2017 (in May and November), and extended throughout the entirety of 2018. The agreement set a reduction in oil supply by 1.8 million barrels per day (Mb/d), with OPEC members accounting for 1.2 Mb/d and non-OPEC countries, including Russia and Mexico, contributing 0.6 Mb/d.

The increase in oil demand and the supply management efforts by OPEC resulted in a significant decline in excess stocks held by OECD countries. These stocks were generally halved between the second quarter of 2016 and the third quarter of 2017. Thus, from this perspective, OPEC's strategy can be considered a success. As a consequence of the rebalancing of the oil market, OPEC's supply management policies, and geopolitical tensions, oil prices surpassed $60 per barrel by the end of 2017 and continued this trajectory until 2019. This proves the significant improvement in 2017 (0,01844844) and 2018 (0,399265067) and 2019 (0,37441085) reflecting better working capital management and financial stability.

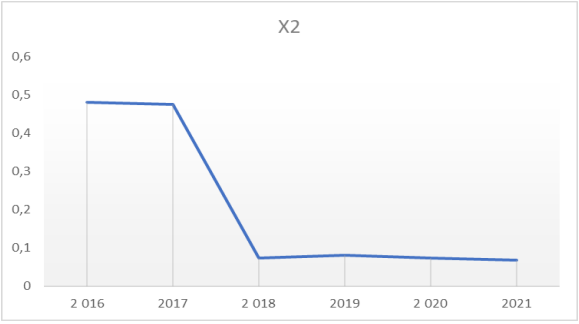
However, there was a dip in 2020 (0,071179854), due to the Covid-19 virus pandemic represented a significant disruption, causing a sharp decline in global economic growth starting from March 2020 (Gadi & Debech, 2021). At the peak of the crisis, by the end of April, the Brent crude oil price plummeted from a level of 50 dollars to below 20 dollars, a value unseen in the past two decades. Subsequently, from June 2020 onwards, the price partially recovered to a range of 40-45 dollars. Although the ratio partially recovered in 2021 (0,111166148). The positive strides made in managing working capital over the analyzed period reflect the company's commitment to sound financial practices and its ability to strike a balance between short-term financial obligations and operational efficiency (Le, Le, & Le, 2021). These efforts are likely to contribute positively to the

company's long-term financial health and reinforce investor confidence.

4.2 Analysis of X2= retained earnings/total assets

The subsequent ratio, X2, assesses the company's capacity to generate earnings with its total assets, known as the retained earnings to total assets ratio. A high X2 close to 1 indicates that the company's growth is primarily financed by its profits rather than increased debt. Conversely, low retained earnings to total assets ratio (X2) suggests that the company chooses to fund its growth through rising debt instead of reinvesting its profits. In other words, the enterprise's growth may not be sustainable in such cases (Swalih, Adarsh, & Sulphey, 2021)**.**

Fig.2. Evolution of the ration X2 between 2016-2021



Source: Conducted by the authors

The data presents the values for ratio X2, representing the retained earnings to total assets ratio, over the years 2016 to 2021. In 2016 and 2017, the ratio shows high values of (0.480075337) and (0.474929044), respectively, indicating that a significant portion of the company's total assets is financed by retained earnings. The X2 ratio's stability in 2016 and 2017 amid moderate oil price volatility indicates that SONATRACH effectively managed its financial performance during this period. The company retained a significant portion of its earnings relative to its total assets, even when oil prices were relatively low.

However, in 2018, there is a sharp decline to 0.072976582, signaling a shift towards more external financing sources or increased reliance on debt. Although the ratio slightly increases in 2019 and 2020, it remains relatively low, at 0.081796236 and 0.07401417, respectively, indicating a continued trend of relying less on retained earnings and reflecting the company's resilience in managing retained earnings during challenging times, including the COVID-19 pandemic and oil price volatility (Heyer &

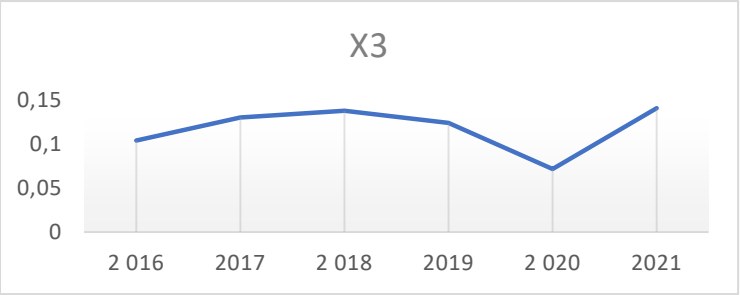
Hubert, 2020). The ratio further decreases to 0.068985778 in 2021, emphasizing the need for investors to closely monitor the company's financial position and funding decisions.

4.3 Analysis of X3= EBIT / Total Assets

The third ratio, EBIT (Earnings Before Interest and Tax) to total assets ratio (EBIT/TA), reveals how effectively the company generates earnings from its assets even before fulfilling contractual obligations. An X3 ratio approaching 100% signifies that the company utilizes its assets efficiently (Lace & Sundukova, 2010). Essentially, it serves as a measure of the company's effectiveness in generating returns from its assets, independent of any funding decisions made by management. The data for ratio X3, representing earnings before interest and tax to total assets, shows the company's ability to generate earnings from its assets over the years 2016 to 2021. The trend indicates fluctuations in this ability during the analyzed period. Starting from 2016, the X3 ratio is 0.103984933, indicating that SONATRACH's net operating expenses were 10.40% of its total assets.

This ratio is relatively low, suggesting that the company managed its operating expenses efficiently during a period of high oil price volatility. This suggests effective asset utilization and operational efficiency, leading to higher profits. The ratio further increases in 2017 (0.130179754) indicating that net operating expenses became 13.02% of total assets. The continued impact of oil price fluctuations on earnings likely influenced the increase in operating expenses. As oil prices recovered from the lows of previous years, operating expenses might have risen alongside increased activities, and 2018 (0.137610758), signifying continuous improvements in generating earnings from assets. This significant increase in operating expenses could be attributed to continued oil price challenges and the need for higher expenditures to cope with market uncertainties.

Fig.3. Evolution of the ration X3 between 2016-2021



Source: Conducted by the authors

The data for ratio X3, representing earnings before interest and tax to total assets, shows the company's ability to generate earnings from its assets over the years 2016 to 2021. The trend indicates fluctuations in this ability during the analyzed period. Starting from 2016, the X3 ratio is 0.103984933, indicating that SONATRACH's net operating expenses were 10.40% of its total assets. This ratio is relatively low, suggesting that the company managed its operating expenses efficiently during a period of high oil price volatility. This suggests effective asset utilization and operational efficiency, leading to higher profits. The ratio further increases in 2017 (0.130179754) indicating that net operating expenses became 13.02% of total assets. This was based on the effectiveness of OPEC's strategy implemented in November 2016 and subsequently renewed in 2017, the efforts to manage supply by OPEC led to a substantial decrease in excess stocks held by OECD countries. These stocks were generally cut in half between the second quarter of 2016 and the third quarter of 2017, thereby contributing significantly to the upturn in oil prices. The continued impact of oil price fluctuations on earnings likely influenced the increase in operating expenses. As oil prices recovered from the lows of previous years, operating expenses might have risen alongside increased activities, and 2018 (0.137610758), signifying continuous improvements in generating earnings from assets. This significant increase in operating expenses could be attributed to continued oil price challenges and the need for higher expenditures to cope with market uncertainties.

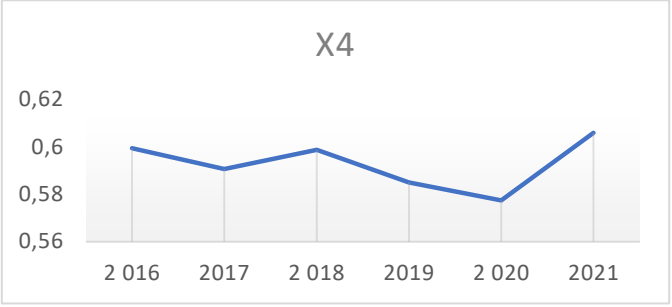
However, there is a slight decline in 2019 (0.123879318), suggesting a modest decrease in the company's ability to generate earnings from its assets compared to the previous years. In 2020, the X3 ratio drops significantly to 0.071403739, indicating a substantial decrease in earnings generated from assets, possibly cost-cutting measures undertaken in

response to the COVID-19 pandemic and the oil price crash, leading to reduced operating expenses. However, in 2021, the ratio rebounds to 0.140518306, showing a strong recovery and higher ability to generate earnings from assets which is a result of increased expenses during the recovery phase from the pandemic and fluctuations in oil prices.

4.4 Analysis of X4= Market value of equity/ total Liabilities

The fourth ratio, X4, which is the Market Value of Equity to Total Liabilities ratio, illustrates the value of the company's assets before reaching insolvency. Companies with ratios exceeding 200% are considered the safest (Lahmar & Senouci, 2022).

Fig.4. Evolution of the ration X4 between 2016-2021



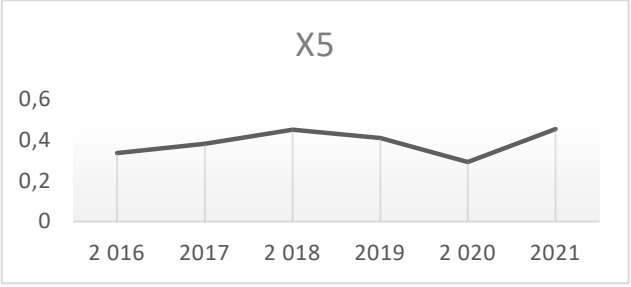
Source: Conducted by the authors

The data for ratio X4, representing the market value of equity to total liabilities, shows the relationship between the company's equity value and its total liabilities over the years 2016 to 2021. The trend indicates relatively stable values for X4 during the analyzed period. Starting from 2016, the X4 ratio is 0.599325932, indicating that the market value of the company's equity is approximately 60% of its total liabilities. This relatively high X4 ratio reflects the company's ability to generate substantial profits despite facing high oil price volatility during the year and suggests a relatively good financial position and positive investor sentiment. The ratio remains consistent in 2017 (0.590539262) and 2018 (0.598728623), indicating a continued balance between equity value and liabilities. In 2019, the X4 ratio experiences a slight decline to 0.584900579, suggesting a small decrease in the proportion of equity value relative to liabilities. However, the ratio remains relatively steady in 2020 (0.577370397) and increases slightly in 2021 to 0.605910512, signaling a potential improvement in the company's financial strength.

4.5 Analysis of X5= Sales / Total Assets

The fifth ratio, X5, defines the management's ability to compete and serves as a standard financial measure to illustrate the sales-generating capability of assets. It reflects how effectively the company's management utilizes its assets to generate sales. A low ratio suggests that the company is not efficiently using its assets to boost sales, whereas a high ratio indicates the opposite. Ideally, this ratio would be close to 2, signifying optimal asset utilization for sales generation. However, a low turnover ratio implies that the company has not fully utilized its assets, which can have a negative impact on its financial performance (Lace & Sundukova, 2010).

Fig.5. Evolution of the ration X5 between 2016-2021



Source: Conducted by the authors

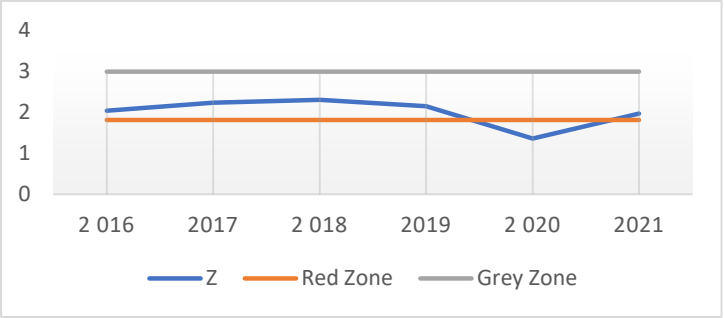
The data for ratio X5, representing the company's sales-generating ability of assets, shows the relationship between sales and total assets over the years 2016 to 2021. The trend indicates fluctuations in the company's ability to generate sales from its assets during the analyzed period. Starting from 2016, the X5 ratio is 0.336835845, indicating that the company generated approximately 33.7% of its total assets as sales. This suggests an effective utilization of assets to generate revenue. The ratio increases in 2017 (0.381362346) and 2018 (0.451583126), indicating an improvement in the company's sales-generating ability, likely due to increased operational efficiency or expansion. The moderate impact of oil price volatility on sales suggests that the company's revenue generation was influenced by oil price fluctuations during this year.

However, in 2019, the X5 ratio experiences a slight decline to 0.409535742, suggesting a small decrease in the company's ability to generate sales from its assets compared to the previous year. In 2020, the X5 ratio drops significantly to 0.291324649. The significant drop in the X5 ratio might be attributed to the combined impact of the COVID-19 pandemic and the sharp decline in oil prices, which affected the company's revenue generation. However, in 2021, the ratio rebounds to 0.454746493,

showing a strong recovery and higher ability to generate sales from assets. The analysis underscores the importance of closely monitoring sales performance and operational efficiency to ensure sustainable revenue generation and business growth.

4.6 Analysis of Altman's Z-score

Fig.6. Evolution of z-score between 2016-2021

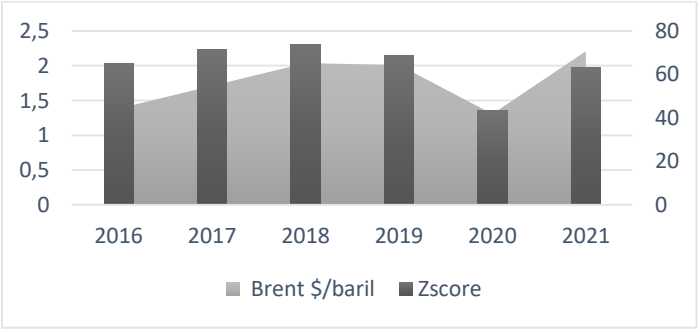


Source: Conducted by the authors

The data for Z-score from 2016 to 2021 shows fluctuations in the company's financial stability. The Z-score values indicate that the company was in the "gray" Zone from 2016 to 2019, suggesting a moderate probability of bankruptcy. However, in 2020, there was a notable drop in the Z-score, moving the company into the "Distress" Zone, indicating potential risks or challenges in its financial performance. Although there was improvement in 2021, with the Z-score increasing, it remained within the "Gray" Zone, suggesting that the company's financial health may still require further monitoring and assessment. Rather, it requires another in-depth study to predict the institution's true ability.

4.7 Analysis of Altman's Z-score and oil prices

Fig.7. Evolution of z-score and oil prices between 2016-2021



Source: Conducted by the authors

The analysis of SONATRACH's financial performance, represented by its Z-score, and the price of Brent crude oil from 2016 to 2021 reveals a

correlation between the two factors (59%). When oil prices are higher, SONATRACH's Z-score tends to increase, indicating a moderate financial position, while lower oil prices correspond to potential decreases in the Z-score, suggesting financial challenges.

As an oil-exporting company, SONATRACH's financial health is significantly impacted by fluctuations in oil prices, as it heavily relies on its oil exports for revenue and profitability. During periods of higher oil prices, SONATRACH benefits from favorable market conditions, resulting in moderate financial performance. However, lower oil prices can lead to potential financial pressures. Thus, to maintain a healthy financial position, the company needs to carefully manage its operations and financial strategies, particularly during periods of oil price volatility.

In 2016 The Z-score for 2016 is 2.033769826, indicating a moderate probability of bankruptcy for the company during this year. The oil prices fell below the $50 threshold as the year 2015 commenced due to an oversupply of oil, primarily stemming from the extensive production of shale oil in the United States, and the impact of oil price volatility on the company's financial performance was moderate. Despite fluctuations in oil prices, the company maintained a moderate financial position. The Z-score for 2017 is 2.233864711, continuing to indicate moderate financial health. The Brent crude oil price increased to 54.825 $/barrel, and the company continued to face the impact of oil price fluctuations. Nevertheless, its financial position remained robust in the gray zone.

The Z-score for 2018 is 2.301796873, which indicates the same situation. The Brent crude oil price further increased to 65.20833333 $/barrel, and the company faced significant challenges due to continued oil price volatility. In addition, the Z-score for 2019 is 2.146365433, showing moderate risk of bankruptcy. The Brent crude oil price remained relatively stable at 64.33 $/barrel. The company experienced a moderate recovery in financial performance amid improved oil market conditions.

The Z-score for 2020 is 1.354451337, which falls within the Red Zone, indicating the company is likely headed for bankruptcy. During this year, the Brent crude oil price experienced a significant drop to 41.767 $/barrel, primarily driven by the unprecedented impact of the COVID-19 pandemic and the subsequent oil price crash. These external factors posed considerable challenges for the company's financial performance. This situation highlights the importance of closely monitoring the company's

financial performance and the need to implement appropriate measures to strengthen its financial position. As market conditions improved and oil prices gradually recovered, the company's financial health might have shown signs of recovery, but it also underscored the significance of resilience and adaptability in navigating through challenging times.

Finally, The Z-score for 2021 is 1.967840829, remaining in the Gray Zone. The Brent crude oil price increased to 70.7 $/barrel, and the company experienced lingering effects of the pandemic and oil market recovery. Financial health showed some improvement from the previous year, but it remained in the Gray Zone.

And, in 2022, the Ukrainian-Russian conflict exerted a notable influence on oil prices, consequently bolstering the financial well-being of oil and gas companies in exporting nations (Senouci, 2022).

5. CONCLUSION

Edward Altman developed Altman's Z-score formula in 1967, which was subsequently published in 1968. Over the years, Altman continuously updated the Z-score to encompass all categories of companies. The primary purpose of utilizing Altman's model, which has become a dependable metric, is to assess the financial health of businesses. In this study of the Z-score and oil prices evaluation, we are discussing SONATRACH’s financial health and the impact of oil prices fluctuations on financial performance of the company during 2016 to 2021.

5.1 Main results

Analysis reveals that even during periods of low oil prices, specifically in 2016, the company consistently encountered the consequences of oil price fluctuations. A potential bankruptcy risk loomed, but the company's ability to sustain its position underscores the effectiveness of its strategy in navigating through price volatility.

However, the unprecedented impact of the COVID-19 pandemic and the oil price crash in 2020 posed a notable drop in the Z-score, moving the company into the "Distress" Zone, indicating risks and challenges in its financial performance. In 2021, SONATRACH’s financial health showed signs of recovery with the increase in oil prices. This situation highlights the importance of implementing a robust policy of resilience and adaptability to navigate through unexpected challenging times that could affect both oil prices and the financial health of oil and gas companies.

The first hypothesis is confirmed, indicating that there is indeed a relationship between the volatility of oil prices and the financial

performance of SONATRACH. However, the second hypothesis is not confirmed, suggesting that the company has not been able to maintain its financial performance during periods of low oil prices, particularly in unpredictable situations such as the COVID-19 pandemic.

5.2 Recommendation

As a recommendation and based on the obtained results, conducting a detailed prospective study in this situation would be valuable for assessing the company's potential to enhance its situation.

6. Bibliography List

- Almamy, J., Aston, J., & Ngwa, L. N. (2016). An evaluation of Altman's Z-score using cash flow ratio to predict corporate failure amid the recent financial crisis: Evidence from the UK. *Journal of Corporate Finance, 36,* pp. 278–285.
- Alquist, R., & Kilian, L. (2010). What do we learn from the price of crude oil futures? *Applied Econometrics, 25(4),* pp. 539-573.
- Altman , E. I. (1968). Financial Ratios, Discriminant Analysis and the Prediction of Corporate Bankruptcy. *J Finance 23: 589*.
- Altman, E. I., Iwanicz-Drozdowska, M., Laitinen, E. K., & Suvas, A. (2014). Distressed Firm and Bankruptcy Prediction in an International Context: A Review and Empirical Analysis of Altman's Z-Score Model. *SSRN Electronic Journal.*, pp. 1-47.
- Altman, E. I., Iwanicz-Drozdowska, M., Laitinen, E. K., & Suvas, A. (2017). Financial Distress Prediction in an International Context: A Review and Empirical Analysis of Altman's Z- Score Model. *Journal of International Financial Management & Accounting, 28(2),* pp. 131-171.
- Anjum, S. (2012). Business bankruptcy prediction models: A significant study of the Altman's Z-score model. *Asian Journal Of Management Research, 3(1),* pp. 2012–2019.
- Apoorva, D. V. (2019). Application of Altman Z Score Model on Selected Indian Companies to Predict Bankruptcy. *International Journal of Business and Management Invention (IJBMI), 8(1),* pp. 77–82.
- Askari, H., & Krichene, N. (2008). Oil price dynamics (2002–2006). *Energy Economics, 30(5),* pp. 2134-2153.
- Bagirov, M., & Mateus, C. (2019). Oil prices, stock markets and firm performance: Evidence from Europe. *International Review of Economics & Finance, 61,* pp. 270–288.
- Bilal, Z. O., Mohammed, S., & Ali, Y. Y. (2021). Oil price fluctuation and firm performance in developing economy: evidence from OMAN. *International Journal of Energy Economics and Policy, 11(3),* pp. 381–387.

- Brewer, G. A., & Walker, R. M. (2010). The impact of red tape on governmental performance: An empirical analysis. *Journal of Public Administration Research and Theory, 20(1)*, pp. 233-257.
- Cındık, Z., & Armutlulu, I. H. (2021). A revision of Altman Z-Score model and a comparative analysis of Turkish companies' financial distress prediction . *National Accounting Review, 3(2)*, pp. 237–255.
- Dayanandan, A., & Donker, H. (2011). Oil prices and accounting profits of oil and gas companies. *International Review of Financial Analysis, 20(5)*, pp. 252–257.
- Gadi, O., & Debech, I. (2021). Impact de la crise sanitaire Covid-19 sur le marché pétrolier : Cas de l'Algérie. *Revue Droit International et Développement, 9(1)*, pp. 01–16.
- Gil-Alana, L. A., Yadollah , D., & Nazari , R. (2020). An analysis of the OPEC and non-OPEC position in the World Oil Market: A fractionally integrated approach. *Physica A: Statistical Mechanics and its Applications, 541(1)*, pp. 1-11.
- Hamilton, J. (1983). Oil and the macroeconomy since World War II. *Journal of Political Economy, 91(2)*, pp. 228–248.
- Heyer, É., & Hubert, P. (2020). L'impact de la baisse du prix du pétrole liée à la crise de la Covid-19 sur les entreprises et ménages français. *Revue de l'OFCE, 168(4)*, pp. 137–162.
- Hsiao, C. Y.-L., Lin, W., Wei, X., Yan, G., Li, S., & Sheng, N. (2019). The Impact of International Oil Prices on the Stock Price Fluctuations of China's Renewable Energy Enterprises. . *Energies, 12(24), 4630*.
- Hui, C.-H., Lo , C.-F., Cheung, C.-H., & Wong, A. (2020). Crude oil price dynamics with crash risk under fundamental shocks. *The North American Journal of Economics and Finance, 54 (101238)*, pp. 1-20.
- Ilic, A., & Ponomarenko, T. (2021). Impact of oil prices on profitability and investment activity of oil companies from central and eastern europe. *E3S Web of Conferences, 266, 06003*.
- Issor, Z. (2018). La performance de l'entreprise : un concept complexe aux multiples dimensions. *Projectics / Proyéctica / Projectique, 17(2)*, pp. 93–103.
- Janor, H., Abdul-Rahman, A., Housseinidoust, E., & Abdul Rahim, R. (2013). Oil price fluctuations and firm performance in an emerging market: Assessing volatility and asymmetric effect. Journal of Economics. *Business and Management, 1(4)*, pp. 385–390.
- Joshi, D. (2019). A study on application of Altman's Z score model in predicting the bankruptcy of Reliance Communication. *International Journal of Management Review, 7(2)*.
- Lace, N., & Sundukova, Z. (2010). Company's standards for financial soundness indicators. *Business And Management*, pp. 112-117.
- Lahmar, M., & Senouci, B. (2022). L'application Du Modèle Prédictif De Détresse Financière D'altman Pour Analyser La Performance Des Entreprises

Du Secteur De L'énergie En Algérie. Cas De Sktm. *Journal Of Economics Studies and Researches in Renewables Energies, 9(2)*, pp. 288-311.

- Le, T. H., Le, A. T., & Le, H. C. (2021). The historic oil price fluctuation during the Covid-19 pandemic: What are the causes? *Research in International Business and Finance, 58, 101489.*
- Misund, B., Osmundsen, P., & Sikveland, M. (2015). International oil company valuation: The effect of accounting method and vertical integration. *Petroleum Accounting and Financial Management Journal, 34(1)*, pp. 1–20.
- Nguyen, T. N., Nguyen, D. T., & Nguyen, V. N. (2020). The impacts of oil price and exchange rate on Vietnamese stock market. Journal of Asian Finance. *Economics and Business, 7(8)*, pp. 143–150.
- Putra, A. P., Lahindah, L., & Rismadi, B. (2013). Financial Performance Analysis Before and After Global Crisis (Case Study in Indonesian Oil and Gas Sector for the Period of 2006-2011). *Integrative Business and Economics Research, 3(1)*, pp. 42–51.
- Ray, S. (2011). Assessing Corporate Financial Distress in Automobile Industry of India: An Application of Altman's Model. *Research Journal of Finance and Accounting, 2(3)*, pp. 155–169.
- Senouci, B. (2022). Il suffirait d'une petite déclaration ou d'une rumeur pour faire grimper les cours. El Moudjahid.
- Su, C. W., Khan, K., Tao, R., & Nicoleta-Claudia, M. (2019). Does geopolitical risk strengthen or depress oil prices and financial liquidity? Evidence from Saudi Arabia. *Energy, 187(116003)*, pp. 1-13.
- Swalih, M. M., Adarsh, K. B., & Sulphey, M. M. (2021). A study on the financial soundness of Indian automobile industries using Altman Z-Score. *Accounting, 7(2)*, pp. 295-298.
- Thanh Tung, D., & Thi Hoang Phung, V. (2019). An application of Altman Z-score model to analyze the bankruptcy risk: cases of multidisciplinary enterprises in Vietnam. *Investment Management and Financial Innovations, 16(4)*, pp. 181–191.
- Yu, Y., Guo, S., & Chang, X. (2022). Oil prices volatility and economic performance during COVID-19 and financial crises of 2007–2008. *Resources Policy, 75, 102531*.