

Assessing Financial Performance for Energy Companies in Algeria: A Comparative Study utilizing Altman's and Almamy's Models. A Case Study of SKTM

LAHMAR Maroua*

Oran Graduate School of
Economics, LAREEM (Algeria)

maroua.lahmar94@gmail.com

SENOUCI Benabbou

Oran Graduate School of Economics,
LAREEM (Algeria)

senouci.ben@gmail.com

Abstract

The company SKTM (Shariket Kahraba wa Taket Moutadjadida) is committed to pursuing its initial objective as suggested by its name, which is the production of electricity from renewable energy sources (EnRs) and ensuring a complete energy transition in its production. This policy requires significant investments. Therefore, the objective of this study is to analyze the financial performance of the company for the period 2016-2019, provide an economic explanation, and perform a comparative analysis of the company's financial health by applying the Altman and Almamy models.

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* Corresponding author

1. Introduction

Today, the world has changed with unprecedented environmental degradation associated with an overall improvement in purchasing power and the emergence of new needs. In the same time of this economic growth, warning signs are appearing such as global warming and disappearance of forests, the proportion of forests in relation to the world's land surface has fallen to 31.2% in 2020 **(Gennari, 2021)** ...Etc. **(Massiera, 2014)**. Therefore, the minimization of negative externalities on the environment, in particular greenhouse gas emissions, requires immediate international action, since the climate change resulting from these global emissions will far exceed the cost of action **(Stern, 2006) (Olivier, 2007) (Percebois & Pommeret , Efficiency and dependence in the European electricity transition, 2021)**.

Thus, the use of renewable energies is imperative notably in a country like Algeria which has a favorable climate for the development and exploitation of the renewable energies sector and a very significant energy potential, in particular solar energy for electricity's production represented by more than five (5) billion GWh/year, with an average of more than 2,500 hours of sunshine per year over a large part of the territory **(Tagrerout & Atmania, 2021)**. This duration can exceed 3,800 hours of sunshine in the highlands and the Algerian desert **(Fenni , 2022)**. In order to achieve this transition toward green sources, different power generation technologies compete with each other based on their availability of supply and their marginal cost of generation (renewable and fossil) **(Benhmad & Percebois, 2018)**. As such and according to the Bruntland 1987 report, the major challenge of nations including Algeria is to ensure real and complete economic development for the current generation, and to guarantee the rights of future generations to the available resources **(Boiteau, 2015)**. This lived situation highlights the need for a more sustainable energy portfolio with greener, inexhaustible and renewable resources **(Ul-Mulk & Reynaud, 2018) (Zermane, Badis, & Zedira, 2018)**, including biomass, solar, wind, hydro, geothermal and marine motive power.

For public companies operating in strategic sectors such as energy. It raises questions that go far beyond the application and realization of exclusive energy policies by the state. In this case, the government can intervene, therefore, directly or indirectly in a dominant way **(Chadlia, 2015)**. As a result, public enterprises pursue not only economic objectives, the maximization of profit, but other objectives related to their positioning and their social roles **(Akrich, Ouabouch, & Elghazi, 2017)**. Consequently, the reason behind this approach is to strike a balance between the economic objectives of achieving financial sustainability and the strategic goals of aligning with government policies and strategies **(Bouyacoub, 1987) (Djadli & Boufalta, 2019)**. By considering state companies as both economic entities and policy implementers, the mechanisms for measuring their performance encompass these dual conjunctures **(Pestieau, 1989)**.

The objective of this work is to analyze the financial performance of renewable energy companies which supports more cost in order to encourage the establishment of renewable energies such as SKTM (Shariket Kahraba wa Taket Moutadjadida) which was created theoretically to produce electrical energy from renewable resources and seeks to return to its objective of creation as its name indicates “electricity production from renewable resources” and ensures a complete energy transition in its production. We shall employ bankruptcy prediction models incorporating different financial ratios as independent variables. Specifically, we shall compare the outcomes of Altman's and Almamy's models in order to evaluate their results in predicting bankruptcy among renewable energy companies. The findings will inform decision-making and promote sustainable development in the energy sector.

2. Literature Review

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, & Leonard , 2015)**. 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. 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 their 2001 study, Grice and Ingram explored the implementation of Z-score within manufacturing firms. The findings of their research indicated a negative outcome when using Z-score in recent periods for bankruptcy prediction. However, they observed a positive correlation between Z-score and the prediction of financial distress, excluding bankruptcy.
- 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)**.
- AloyNiresh, J and Pratheepan, T (2015), examine the likelihood of bankruptcy of the firms belonging to the Trading Sector in Sri Lanka. The research used data from the financial reports of seven trading companies for a period of five years from 2010 to 2014 **(Aloy Niresh & Pratheepan, 2015)**.

- In the study conducted by McCarthy in 2017, the main objective was to assess the predictive abilities of both the Altman Z-score model and the Beneish M-score model in identifying corporate failure and financial manipulation within Enron Corporation. The findings of the research concluded that for such studies, it is advisable to employ both Altman's Z-score model and Beneish's M-score model concurrently, as they complement each other effectively **(MacCarthy, 2017)**.

- 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)**.

- Diep TT and Vo Thi (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 **(Diep & Vo Thi, 2019)**.

Due to the importance of predicting financial performance and financial distress. Altman's predictive model took the first step, which became the prototype for many models based on internal interest rates. One notable example is Almamy's J model, which has gained recognition in the field **(Harjans, 2018)**.

2.1 Altman's z-scores

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 **(Diep & Vo Thi, 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, **(Eidleman, 1995) (Joshi, 2019)**:

- X_1 = Working Capital / Total Assets;
- X_2 = Retained earnings / Total Assets;
- X_3 = EBIT / Total Assets;
- X_4 = Market value of equity/ total liabilities;
- X_5 = Sales / Total Assets;

We distinguish several formulas for estimating the Z score depending on the type of company **(Joshi, 2019)**. For non-manufacturing companies and emerging markets (as in our

study case) (**Altman, Iwanicz-Drozdowska, Laitinen, & Suvas, 2014**), the Z-score formula and analysis is presented as:

$$Z = 3.25 + 6.56X_1 + 3.26X_2 + 6.72X_3 + 1.05X_4$$

2.2 The Almamy's model

In 2015, Jeehan Almamy, John Aston, and Leonard N. Ngwa introduced the J-model specifically tailored for assessing the financial health of UK companies. This novel model served as an extension to Altman's original z-score model (1968), enhancing its predictive capabilities. The J-model incorporated an additional variable, namely the ratio of cash flow from operations to total liabilities, to provide a more comprehensive assessment of company stability. By introducing this new variable, the researchers made a valuable contribution to the field of bankruptcy prediction, further refining the understanding of company solvency (**Almamy, Aston, & Leonard, 2015**) (**Harjans, 2018**).

Their study involved a comprehensive analysis of companies, conducted before, during, and after the financial crisis. The researchers examined the performance of these companies using their newly developed J-model and also applied Altman's z-score model to the same dataset. By comparing the results obtained from both models, they were able to assess the effectiveness and reliability of each model in predicting financial distress and evaluating the impact of the financial crisis on company health (**Nelissen, 2018**). This comparative analysis provided valuable insights into the strengths and limitations of each model in different economic contexts (**Almamy, Aston, & Leonard, 2015**). Their equation is:

$$J = 1.484J_1 + 0.043J_2 + 0.39J_3 + 0.004J_4 - 0.424J_5 + 0.75J_6$$

With

- J_1 = Working Capital / Total Assets;
- J_2 = Retained earnings / Total Assets;
- J_3 = EBIT / Total Assets;
- J_4 = Market value of equity/ total liabilities;
- J_5 = Sales / Total Assets;
- J_6 = cash flow from operations/total liabilities.

For both models:

- $Z(J) > 2.6$ "Safe" Zone;
- $1.1 < Z(J) < 2.6$ "Gray" Zone;
- $Z(J) < 1.1$ "Distress" Zone.

A recent study revealed that in addition to financial ratios, corporate governance indicators also play a crucial role in predicting company failure. However, the study acknowledged that the relevance of these indicators may vary across different global markets. For instance, in

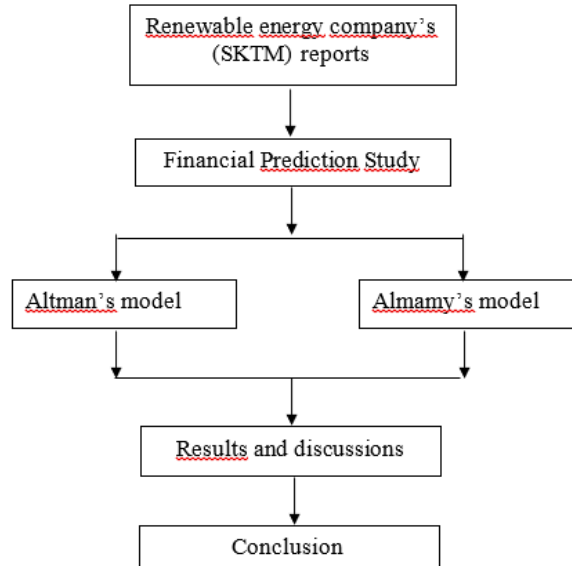
markets with an ambiguous definition of distressed companies or where corporate governance indicators are not well-defined, relying solely on these indicators may not be suitable. It highlights the importance of considering market-specific factors when applying predictive models and selecting appropriate indicators for accurate bankruptcy predictions (Liang, Lu, Tsai, & Shih, 2016).

3. Data and methods

First of all, SKTM is a share company with a capital of 38,700,000,000 DZD, all its shares go back to the Sonelgaz group, created in a context marked by two major factors, the first one is the need to satisfy the demand for electricity in the great Algerian south, in the best conditions of quality and the continuity of service, as part of the public service mission it supports. The second is the development and the promotion of renewable energies, integrated into government policy since 2001, through the adoption of the national program of renewable energies and energy efficiency, which has become a national priority. It should be rightly pointed out that the company has acquired experience in the new field of renewable energies, which it gladly shares with other actors, invested in renewable energies, like several Ministries, Sonatrach, universities and research centers (Alichikouche , 2014).

In this research financial and market data from enterprise exercising in renewable energy sector (SKTM: Shariket Kahraba wa Taket Moutadjadida) between the period of 2016 - 2019. Our analysis will encompass an examination of the financial health of renewable energy company using the established Altman's z-score model. Additionally, we shall employ the recently developed J-score to compare the results. This comparative analysis aims to determine whether incorporating additional financial ratios in the J-score yields distinct outcomes compared to the traditional Altman's z-score model. By evaluating the divergence in results, we can gain insights into the effectiveness of different financial ratios in predicting the financial health of companies.

Fig.1. Research methodology



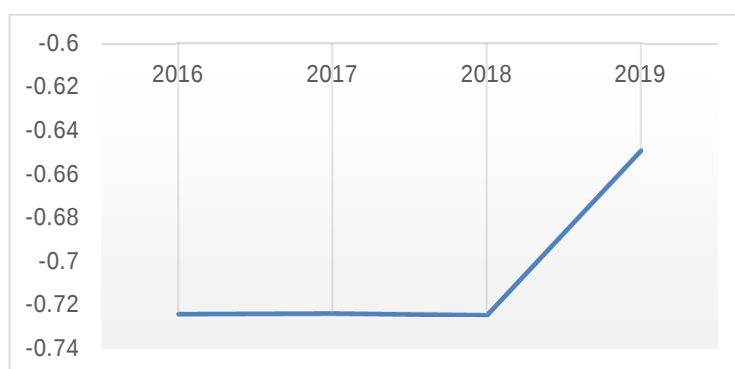
Source: realized by the authors.

4. Results and Discussions

Both the bankruptcy models developed by Altman in 1968 and Almamy in 2015 serve as the basis for this research. Wherein Almamy's model is an extension of Altman's model we shall utilize the variables that constitute the ratios proposed by Altman, along with an additional ratio introduced by Almamy to yield more accurate outcomes, in order to evaluate the financial health of the most important renewable energy company SKTM in Algeria between 2016 and 2019.

4.1 Analysis of $X_1(J_1)$ = working capital/total assets

Fig.2. Evolution of the ration $X_1(J_1)$ between 2016-2019



Source: realized by the authors.

In the conducted study, the proportion of working capital within the total assets $X_1(J_1)$ was subject to fluctuations. From 2016 to 2017, there was a slight increase from -72.39% to -72.35%. Subsequently, there was a slight decrease, reaching -72.44% in 2018. However, in 2019, a notable improvement was observed, with the working capital achieving its highest value of -64.91%.

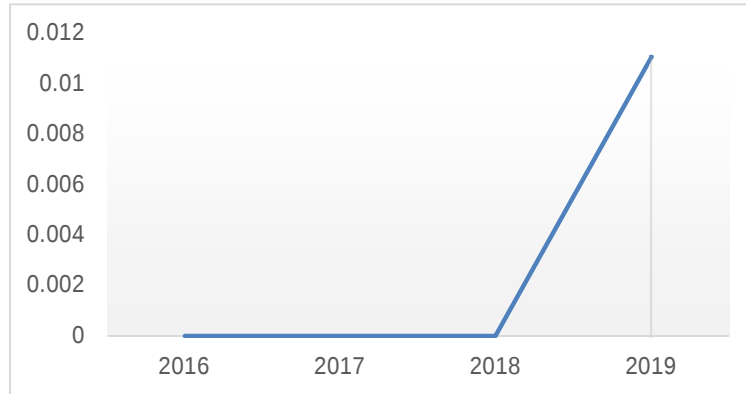
A negative working capital signifies that the current liabilities of the firm surpass its current assets, as indicated in the firm's balance sheet. This shows that the company possesses more current liabilities than current assets. While negative working capital may initially suggest significant problems or even a potential disaster, it can also serve as a means to expand the business using external funds, i.e., other people's money. Consequently, a declining working capital ratio over an extended period may raise concerns and warrant further analysis.

From an economic perspective, the expansion of the company aligns with the concept of energy transition. By adhering to government directives, SKTM endeavors to reduce its dependence on fossil fuels by generating electricity through solar energy while considering its unique characteristics, which has captive uses and is non-storable (Percebois J. ,

Ouverture à la concurrence et régulation des industries de réseaux: le cas du gaz et de l'électricité, 2003). Although this undertaking may give rise to short-term investment concerns and financial risks, its long-term implications are anticipated to have a positive influence on both economic and environmental performance.

4.2 Analysis of $X_2(J_2) = \text{retained earnings/total assets}$

Fig.3. Evolution of the ration $X_2(J_2)$ between 2016-2019



Source: realized by the authors.

The subsequent parameter, $X_2(J_2)$, serves as a quantitative measure of the company's capacity to amass earnings utilizing its total assets. Specifically, it represents the ratio of retained earnings to total assets. A significantly high $X_2(J_2)$ value in close proximity to unity signifies that the company's growth is not reliant on amplified debt, but rather stems from its profitability. Conversely, low retained earnings to total assets ratio indicates that, instead of reinvesting its profits, the company chooses to finance its expansion through heightened indebtedness. Consequently, the viability of the enterprise's growth trajectory may be called into question.

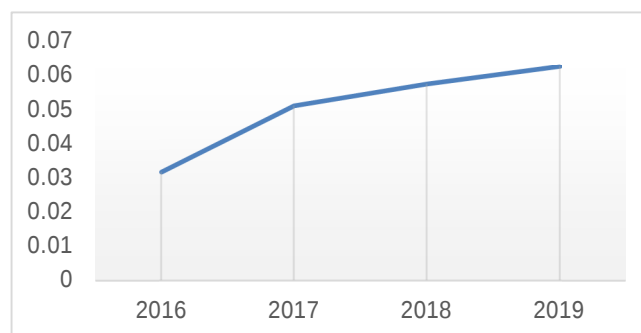
In our study case, for the first three years we had no retained earnings. But, in 2019, $X_2(J_2)$ equals to 0.01 which means SKTM has not been able to pay off major portion of assets out of reinvested profit, and that is not a good sign for renewable energy companies' performance and industry in general.

Returning to the economic perspective, the aforementioned findings substantiate the core objective of the company: fulfilling the demands of the populace and guaranteeing compliance with governmental regulations. The primary focus of this state-owned enterprise lies in its societal role rather than prioritizing profit generation and reserve accumulation. However, this presents a notable challenge due to the predetermined electricity pricing established by the Algerian government through administrative measures, which falls short of covering the production costs. Consequently, SKTM finds itself in a difficult predicament, caught between the pursuit of economic efficiency and the responsibility to fulfill its role as a state-owned company that prioritizes the implementation of government policies. It

encounters the dilemma of sacrificing short-term financial performance to prioritize the environmental and governmental dimensions, thereby ensuring long-term overall effectiveness.

4.3 Analysis of $X_3(J_3) = EBIT / \text{Total Assets}$

Fig.4. Evolution of the ration $X_3(J_3)$ between 2016-2019



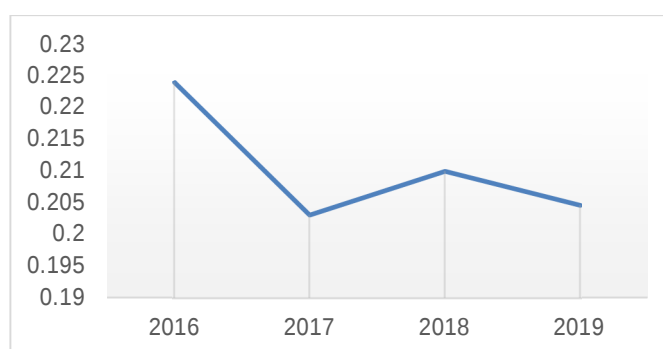
Source: realized by the authors.

The third ratio, denoted as EBIT/TA (Earnings Before Interest and Tax/Total Assets), elucidates the manner in which the company generates earnings through its assets before fulfilling contractual obligations. This ratio, referred to as $X_3(J_3)$, represents the proportion of EBIT/TA. An $X_3(J_3)$ value approaching 100% indicates that the company utilizes its assets in a highly efficient manner. It serves as a metric that captures the company's effectiveness in generating returns from its assets, irrespective of any funding decisions made by management.

The results obtained reveal that SKTM's EBIT/total asset ratio increased from 3.17% in 2016 to 5.11% and 5.75% in 2017 and 2018, respectively, reaching its highest level of 6.26% in 2019. This upward trend is a positive indication as long as it continues to increase. However, it is important to note that the ratio is still relatively low and far from reaching 100%. Therefore, the company should exercise caution and take measures to improve the ratio.

4.4 Analysis of $X_4(J_4) = \text{Market value of equity} / \text{total Liabilities}$

Fig.5. Evolution of the ration $X_4(J_4)$ between 2016-2019



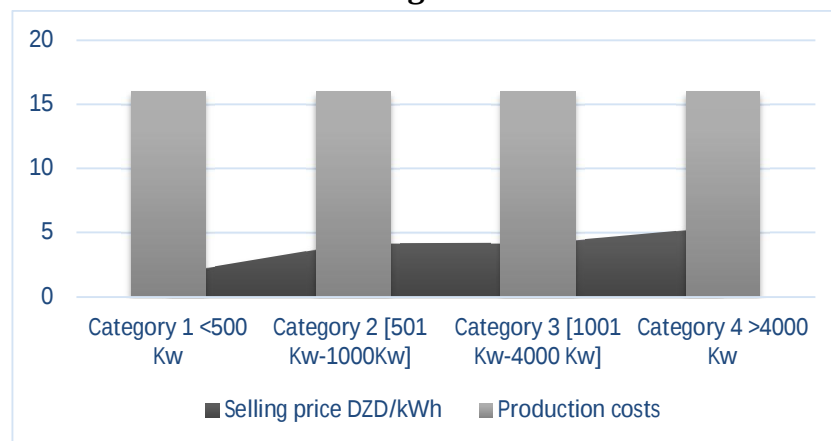
Source: realized by the authors.

The ratio $X_4(J_4)$, which is the Market Value of Equity to Total Liabilities ratio, provides insight into the value that the company's assets hold before reaching insolvency. Companies with ratios exceeding 200% are considered to be the most secure and safe.

The $X_4(J_4)$ ratio in this case study ranged from 22.40% in 2016, experiencing a slight decrease to 20.31% in 2017. Since then, the ratio has continued to fluctuate, reaching 21% in 2018, only to decrease again to 20.45% in 2019. The decline in this ratio indicates that the company's production costs are relatively higher compared to the selling price.

From an economic perspective, SKTM generates electricity from both renewable and non-renewable resources. Given that the energy sector is a strategic sector that impacts the entire economy, the Algerian government intervenes through various policies to achieve social harmony and satisfy citizens by ensuring continuous supply at a pre-determined fixed and affordable price. Additionally, the government also endeavors to encourage the transition towards renewable energy resources, which requires substantial investments. On one hand, costs increase and on the other one the selling price remains fixed, as evidenced by the obtained results. It is important to note that production costs depend on the power station and the primary energy utilized. In certain regions, such as the Algerian south, where diesel fuel is used to generate electricity, the production cost exceeds 16 DZD/kW. The pricing is divided into four tiers, as illustrated in Fig.06 below:

Fig.06: The difference between the production cost and the selling price of electricity in Algeria

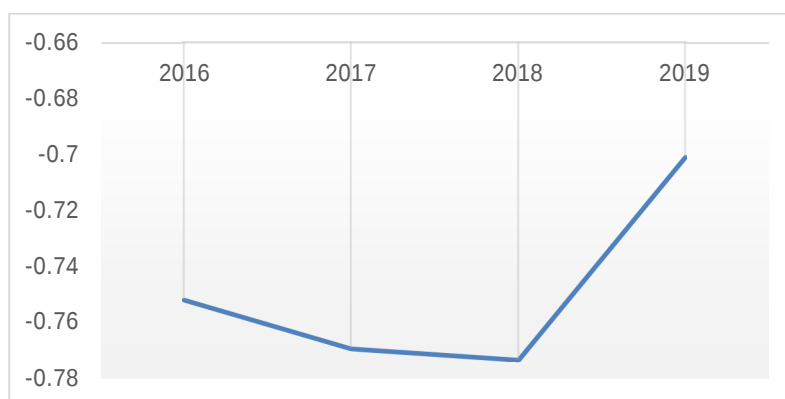


Source: realized by the authors using data from (Attar, 2021)

In line with Altman's analysis methodology, the $X_5(J_5)$ ratio is not incorporated as part of the assessment. This omission is due to our specific focus on non-manufacturing companies and emerging markets, aligning with Altman's approach.

4.5 Analysis of $J_6 = \text{cash flow from operations}/\text{total liabilities}$

Fig.7. Evolution of the ration (J_6) between 2016-2019



Source: realized by the authors.

The operating cash flow ratio provides insight into a company's ability to meet its current debt obligations using the cash generated within the same period. A ratio greater than one (100%) indicates that the company has generated more cash than necessary to cover its current liabilities, which is considered positive. Conversely, an operating cash flow ratio below one suggests that the company has not generated enough cash to fulfill its current debt obligations. This may raise concerns among investors and analysts, indicating a potential need for additional capital. It is important to note that a low operating cash flow ratio does not always indicate poor financial health. There could be various interpretations, including scenarios where a company temporarily experiences compromised cash flows due to a strategic project or investment that is expected to yield significant rewards in the future. Thus, a comprehensive analysis is required to understand the specific circumstances and implications of the operating cash flow ratio.

During the period from 2016 to 2019, the J_6 ratio for SKTM exhibited a relatively stable but consistently negative trend. Starting at -0.752057491 in 2016, the ratio slightly decreased to -0.769402778 in 2017 and further declined to -0.773390783 in 2018. However, there was a slight improvement in 2019, with the ratio decreasing to -0.701002561. Although the improvement suggests a reduced gap between cash flow from operations and total liabilities, SKTM still struggled to generate sufficient cash flow to cover its obligations throughout the analyzed period. This indicates a persistent challenge for the company in managing its cash flow and highlights the need for focused efforts to enhance operational efficiency and financial stability.

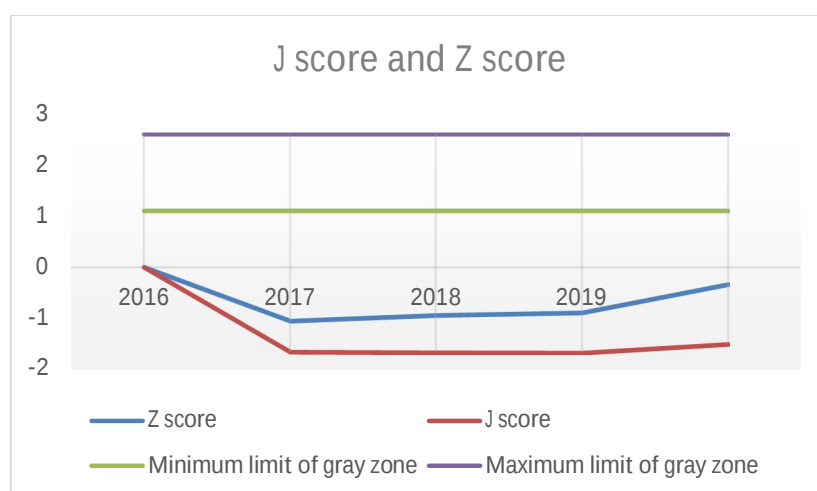
These results are directly linked to SKTM's strategic objective of transitioning to renewable and clean energy sources. As SKTM focuses on producing electricity from renewable sources, it is expected that this transition will require significant investments in infrastructure, technology, and operational activities. These investments may temporarily impact the company's operating cash flow, resulting in a lower operating cash flow ratio.

However, it is important to view this in the context of the company's long-term goals. SKTM's commitment to renewable energy and clean sources indicates a strategic vision that extends beyond immediate financial considerations. The investments made towards transitioning to clean energy sources are aimed at reaping substantial rewards in the future, such as reduced reliance on non-renewable resources and lower environmental impact.

Therefore, while the operating cash flow ratio may be affected in the short term due to the investments associated with the transition, it should be considered within the broader context of SKTM's strategic shift towards renewable energy. By aligning their operations with sustainable practices, SKTM is positioning itself to capitalize on the increasing demand for clean energy solutions and contribute to a greener and more sustainable energy landscape.

4.6 Z-score and J-score

Fig.8. Evolution of the Z-score and J-score between 2016-2019



Source: realized by the authors.

The Z-score values for SKTM show a mixed trend over the years. In 2016, the Z-score was -1.050890208, indicating a higher risk of financial distress. However, there was a slight improvement in 2017 with a Z-score of -0.939403059. The trend continued, with further improvement in 2018, where the Z-score reached -0.894912284. The most significant improvement was observed in 2019, with a Z-score of -0.336666169, suggesting a lower risk of financial distress compared to the previous years. Although the Z-score improved over time, it is important to note that negative values still indicate a certain level of financial vulnerability. According to Altman, this places SKTM in the red zone, indicating financial distress with a Z-score below 1.1 and a high probability of bankruptcy.

The J-score values for SKTM consistently remain negative throughout the years. In 2016, the J-score was -1.653052571, which decreased slightly to -1.669322779 in 2017. Similarly, in 2018, the J-score decreased further to -1.675326099. However, there was a slight

improvement in 2019, with a J-score of -1.510115552, suggesting a relatively lower level of financial distress compared to the previous years.

It can be noted that both the Z-score and J-score indicate the financial health of SKTM. The Z-score shows a relatively more favorable trend over the years, with an improvement from negative values in 2016 and 2017 to a less negative value in 2019. On the other hand, the J-score remains consistently negative throughout the years, indicating financial distress. Overall, both scores suggest that SKTM has faced financial challenges, with the Z-score showing a relatively more optimistic trend compared to the J-score.

By incorporating the J_6 ratio alongside the Z-score, the evaluation takes into account not only profitability and leverage measures but also the company's cash flow generation. This provides a more comprehensive assessment of SKTM's overall financial stability and sustainability. It sheds light on the company's capacity to generate cash from its operations to cover its obligations, which is a crucial aspect in determining its long-term financial viability.

5. Conclusion

The Z-score model developed by Altman is widely used to assess the likelihood of bankruptcy or financial distress. It takes into account various financial ratios. By applying the Z-score model to SKTM's financial statements, it provides an objective measure of the company's overall financial stability and the probability of facing a financial crisis.

On the other hand, the J-model evaluates the financial health of companies. The authors made a valuable contribution to Altman's original Z-score model by incorporating an additional variable: cash flow from operations divided by total liabilities. This inclusion aims to provide more precise and insightful results regarding the financial well-being of the companies being assessed.

By utilizing both the Z-score and J-score models, analysts can gain a more comprehensive understanding of SKTM's financial health. These models provide complementary perspectives, assessing not only the company's overall financial stability but also the reliability of its financial statements. This multi-dimensional evaluation enhances the accuracy and reliability of the assessment, enabling stakeholders to make more informed decisions regarding SKTM's financial position and potential risks. Ultimately, the combined analysis of the Z-score and J-score models contributes to a more robust evaluation of SKTM's financial performance and supports the company's efforts towards achieving sustainable growth, financial resilience and applying the government policy of energy transition towards renewable energy sources in order to ensure a sustainable future and addressing environmental concerns.

However, it is important to recognize the financial challenges that can arise during this transition. The costs associated with infrastructure upgrades, technology adoption, and

storage solutions can significantly impact the company's financial performance, especially in this situation where the prices of electricity are not adequately regulated or compensated. While this may impact the company's financial performance in the short term, it represents a strategic move towards long-term sustainability.

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