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**A ROBUST MEDIAN CUSUM CHART FOR MONITORING HIGH-RISK STOCK  
IN MALAYSIA**

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**ABSTRACT**

This study analyzes stock price fluctuations and develops a robust monitoring approach for high-risk stocks. It identifies key factors influencing stock price volatility, constructs a median CUSUM control chart as an alternative to the mean CUSUM chart, which requires a normality assumption unsuitable for stock price data, and compares the median CUSUM chart's performance during and after COVID-19. A Fishbone diagram is used to determine factors contributing to stock price fluctuations, while a risk matrix helps identify high-risk stocks. The median CUSUM control chart is then applied to monitor stock performance, focusing on FINTEC Global Berhad. Findings indicate that during and after COVID-19, FINTEC's stock performance declined due to financial management challenges that affected investor sentiment. The study highlights the effectiveness of the median CUSUM chart in detecting small shifts in stock fluctuations compared to the mean CUSUM chart. This approach provides a more reliable framework for monitoring stock risk and volatility. By integrating quality tools such as the Fishbone diagram and risk matrix, this study enhances risk assessment strategies in financial market analysis, offering valuable insights for investors and analysts navigating uncertain market conditions.

**Keywords:** COVID-19 impact, high-risk stocks, median CUSUM control chart, non-normal data, stock price fluctuation.

## INTRODUCTION

Finance is the study of money, currency, and capital assets. A key component of financial markets is the stock market, where stocks and derivatives are traded (Gratton, 2024). The stock market, comprising primary and secondary markets, enables companies to raise capital through initial public offerings (IPOs) and allows investors to trade shares. It reflects the financial health and growth prospects of businesses and economies worldwide.

The stock market involves various participants, including individual and institutional investors, as well as traders exploiting short-term price changes. Successful participation requires understanding risk, corporate performance, financial principles, and economic trends. Stock exchanges facilitate transactions, while investors drive market activity. Stock prices fluctuate based on supply and demand, economic conditions, and sentiment (Fama, 1970). This study aims to examine the factors influencing these price movements.

This research focuses on Bursa Malaysia, the national stock exchange, which manages listing, trading, settlement, and depository functions. Bursa Malaysia operates three markets: the Main Market for established companies, the ACE Market for high-growth firms, and the LEAP Market for SMEs seeking capital. Understanding these segments is crucial for assessing stock performance and investment risk.

Given these distinct segments, stock risk levels vary across the markets. Companies in the ACE and LEAP markets tend to exhibit greater volatility due to their growth orientation or smaller scale, making them more sensitive to market fluctuations. Examining how market structure impacts stock risk is vital to identifying high-risk stocks.

This study also considers the characteristics of high-risk stocks, defined as investments with high potential returns but equally high chances of loss (Kadhun et al., 2018). High-risk stocks often display greater price volatility, reflecting significant annual gains or losses (Hidayana et al., 2022). Therefore, the magnitude and frequency of price changes are key indicators of high-risk stocks.

Market capitalization is another key indicator of high-risk stocks, reflecting company size and volatility. Studies show that small-cap companies are generally more volatile and riskier than large-cap firms (Lim et al., 2022; Rohuma, 2023). The FTSE Bursa Malaysia Index covers various segments, though without fixed thresholds. The MidS Cap Index defines mid-cap stocks as between RM 200 million and RM 2 billion, while AHAM Asset Management considers small caps below RM 2 billion. For this study, however, we adopt a more conservative threshold, defining small-cap and high-risk stocks as those with a market capitalization under RM 200 million.

Additionally, return on equity (ROE) positively and significantly affects market capitalization (Fitrah et al., 2022). ROE is another indicator of stock risk, reflecting profitability relative to shareholders' equity. Low or negative ROE is associated with higher volatility and systematic risk (Ahsan, 2012), supporting the high-risk, high-reward principle. However, few studies define a clear ROE threshold. Unfortunately, according to the Business Development Bank of Canada (BDC), a 5% ratio of ROE would be considered low. Based on BDC guidance, this study considers stocks with ROE below 5% as high-risk.

High-risk stocks, in particular, are characterized by greater volatility, extreme price fluctuations, and a higher likelihood of significant deviations from expected returns. These characteristics make them more susceptible to non-normality effects, rendering traditional Statistical Process Control (SPC) tools less effective. Existing studies have highlighted the limitations of Cumulative Sum (CUSUM) and other

control charts, such as Exponentially Weighted Moving Average (EWMA), when applied to non-normal financial data. For instance, non-normality and high autocorrelation in stock prices can render portfolio analysis ineffective, producing out-of-limit results and misleading signals (Dumičić & Žmuk, 2015). While SPC tools have been proposed for risk control in systematic trading and investment (Hassan, 2010), their reliance on normality assumptions limits their applicability in real-world stock market scenarios, especially for high-risk stocks that exhibit pronounced non-normal behaviour.

High-risk stocks often exhibit extreme volatility and non-normal price behaviour, limiting the effectiveness of traditional Statistical Process Control (SPC) tools like Cumulative Sum (CUSUM) and Exponentially Weighted Moving Average (EWMA), which assume normality (Dumičić & Žmuk, 2015; Hassan, 2010). Alternative approaches have been explored, including time series models, regression, and modified control charts. ARIMA and GARCH models improve forecasting by accounting for autocorrelation and volatility but perform poorly with small or highly non-linear datasets (Kumar et al., 2022; Lai, 2023). The fact that this ARIMA control chart can only identify the signal after the day's closing price, when any news has affected the share price, is one of its limitations (Tan et al., 2022). Another study from Rosli et al. (2023) found that ARIMA was proven to be consistent and precise in forecasting value companies. However, the non-linear properties existing in the stock market make the ARIMA model a weak forecasting instrument. Similarly, linear and multiple regression help analyze stock-price drivers, but accuracy depends on large datasets and may not handle non-linearity well (Dimic et al., 2016; Yiming et al., 2024; Sangeetha & Alfia, 2024).

Control charts remain widely used for monitoring stock trends. EWMA is effective for sudden changes, while CUSUM is better for gradual shifts (Hassan et al., 2010). However, both require normality assumptions, which high-risk, volatile stocks often violate. However, this assumption may not always hold true in financial data, which can exhibit non-normal distributions and serial correlation. Hence, the result from the study turns out to be out of control. In conclusion, CUSUM can be the best method in monitoring stock when the normality assumption is appropriately addressed.

Given these challenges, there is a critical need to develop robust models that can effectively monitor and analyze high-risk stocks, which are inherently more volatile and prone to extreme outcomes. This study focuses on addressing this gap by constructing a CUSUM control chart model that replaces the traditional sample mean with a robust median estimator. By leveraging the median's resilience to outliers and non-normality, the proposed model seeks to enhance the accuracy and reliability of monitoring high-risk stocks in Bursa Malaysia. The study will specifically analyze the characteristics of high-risk stocks, such as their heightened volatility, skewness, and fat-tailed distributions (Pokharel et al., 2024; Li & Du, 2024), to develop a tailored approach for identifying and managing risks associated with these stocks.

SPC techniques have been widely used in industrial processes to monitor trends and improve quality (Yeganeh & Shongwe, 2023). Control charts, introduced by Walter A. Shewhart in the 1920s, are among the most effective SPC tools for monitoring process stability. One such control chart is the cumulative sum (CUSUM) chart, which is particularly useful for detecting small shifts in process trends. However, traditional CUSUM charts assume normality in data distribution.

Tsagris and Pandis (2021) emphasize the necessity of normality assumptions in statistical tests. Deviations from normality can lead to inaccurate control limits and misleading results in portfolio analysis and trading systems (Dumičić & Žmuk, 2015). In cases where stock prices exhibit non-normal distributions, SPC tools such as CUSUM and exponentially weighted moving average (EWMA) control

charts may produce unreliable outcomes. Hassan (2010) suggests integrating SPC techniques with financial metrics to enhance risk management in trading and investment.

Given the non-normality of stock price data, this study aims to develop a robust CUSUM model for monitoring high-risk stocks in Bursa Malaysia. The proposed model will utilize a median estimator instead of the sample mean to enhance robustness. This approach will facilitate accurate monitoring and analysis of stock trends.

The primary goal of this research is to analyze Bursa Malaysia's stock market using statistical process control techniques. The specific objectives of the study are:

1. To determine the factors influencing stock price fluctuations.
2. To assess the effectiveness of the median CUSUM control chart in monitoring high-risk stock prices compared to the traditional mean CUSUM chart.
3. To compare stock performance using the median CUSUM chart before, during, and after the COVID-19 pandemic.

In order to achieve the first objective, it is essential to examine the various factors that contribute to stock price fluctuation. Previous studies have highlighted many factors that can impact the fluctuation of stock prices. Investor sentiment positively impacts market liquidity (Hu et al., 2019), and in this context, it means the ease with which assets, such as stocks or bonds, can be bought or sold in the market. Hence, traders' behavior and investor strategies influence the stock price movements by affecting market demand and supply. The Chinese stock market has a general perception that plays a decisive role in manipulating stock prices (Pan et al., 2023). Traders and investors were being manipulated in their investments. Hence, the stock price can be in high demand. In addition, stock prices fall at the announcement of policy changes (Pastor & Veronesi, 2010). Policy changes related to taxation, regulation, interest rate, or monetary policy could affect the investor's decision and lead to a fall in the stock price.

Factors of fluctuation in stock prices can also be caused by the system itself. The stock exchange system somehow had its own risks, such as cybersecurity risk (Smith, 2023). Cyber terrorism significantly reduces the stock prices of affected companies. Cyberterrorism can jeopardize investors' decisions due to a weak security system. The proposed system using deep reinforcement learning (DRL) and gated recurrent unit (GRU) achieved encouraging profit values in stock trading (Ansari et al., 2022). The DRL method and trading utilized for algorithm trading have resulted in investors' decisions without studying the pattern of stock prices. A forecasting network was built on a GRU to capture more informative and inherent aspects of time-series financial data. Hence, the automated trading bots help traders decide when to buy stocks, which creates high demand for stocks. High demand for stocks can trigger an increase in stock prices.

Besides, the publication of financial statements significantly impacts stock prices (Njoroge, 2021). A study analyzing firms listed on the Moscow Stock Exchange found that the release of corporate news, including financial reports, leads to notable changes in stock prices. This effect underscores the importance of transparent financial reporting in influencing investor decisions and market dynamics. Next, accurate stock valuation is crucial for predicting stock price movements. (Boozer et al., 2017) indicates that financial statement variables, such as revenue changes and net income, can predict stock prices. He highlights the role of fundamental analysis in assessing a company's intrinsic value and its

influence on stock performance. As a result, investors rely on stock valuation to make informed choices about buying, holding, or selling shares.

Uncertainty shocks to the economy impacted the financial market, especially gross domestic product (GDP), credit, and stock markets (Gomez-Gonzalez et al., 2024). A study by Rahman et al. (2009) shows how responsive the Malaysian stock market is to shifts in the macroeconomic factors. Macroeconomic changes could lead to stock prices rising or falling. Tee et al. (2023) found that sanctions can influence global stock markets through their study of the financial sanctions and global stock markets regarding the Russian-Ukrainian conflict. A study found that major political events cause the stock market to react (Annawi, 2020). Political events like elections, conflicts, or leadership changes could influence investor confidence, market stability, and stock price movements. In addition, during 2019, the world was shocked by the pandemic COVID-19, which impacted every aspect of daily life. A pandemic is a widespread occurrence of an infectious disease over a whole country. The stock market also had no exception from the pandemic (Morens et al., 2009).

Market capitalization could impact the stock price movement (Pavone, 2019). Market capitalization is the total value of a company's outstanding shares. Market capitalization is also used to determine a company's size and then compare the company's financial performance to other companies of various sizes. It had an impact on investor decisions by studying the company's performance. Next, volatility represents the magnitude of stock price changes, the greater the stock price increases or decreases. The more intense the price action back and forth, the greater the volatility, and vice versa (Lai, 2023). Volatility helps investors estimate future fluctuations. As a result, it builds confidence in investors or traders when buying or selling a company's stock.

Since market capitalization and volatility play a crucial role in stock price movements and investor confidence, they also serve as important indicators in identifying high-risk stocks. High-risk stocks can be found across various sectors, including energy, financial, healthcare, property, and technology. However, this study focuses on identifying high-risk stocks based on the key factors influencing the stock market.

The high-risk stock can be in many sectors, like the energy sector, the financial sector, the healthcare sector, the property sector, and the technology sector. However, this study, which considered the high-risk stock identification, was based on the factors that impact the stock market. There were multiple factors that fluctuated the stock price, including macroeconomic factors, the pandemic, government changes or political issues, and sanctions. All these factors were taken into account regarding the issue in these five years. The impact of macroeconomics gives leverage to the financial sectors (Saizal & Sarma, 2015). In 2019, the whole world was shocked by the pandemic and restrictions in every country. The finance, healthcare, and plantation sectors were most significantly affected by the pandemic (Chee et al., 2024).

According to Edirisuriya (2007), the financial services sector was changed due to reform measures taken by the government and industry. Government changes and political issues can significantly impact the financial services sector and, consequently, the stock market. Regulatory reforms, shifts in monetary policy, and political instability can alter the operating environment for financial institutions, affecting their profitability and stock performance. For example, changes in banking regulations or tax laws can influence profitability and compliance costs, while political instability or uncertainty can increase market volatility and risk premiums. Additionally, monetary policy decisions, such as interest rate changes by central banks, directly affect financial institutions' earnings through their impact on lending rates and investment returns. In the year 2022, Malaysia underwent a political change where a new

prime minister was appointed. Overall, political and governmental actions introduce uncertainty and can lead to significant fluctuations in stock prices within the financial services sector.

According to Tee et al. (2023), the financial market was also impacted during the sanctions season. Hence, the financial market could be in all fields, including the financial service sector. Sanctions and boycotts can severely impact the financial services sector by restricting market access, reducing revenue streams, and increasing compliance costs. When governments impose sanctions or trade restrictions, financial institutions may face limitations in conducting transactions with sanctioned entities or countries, leading to operational disruptions and potential losses. A boycott campaign was declared by the whole nation due to the war in Palestine starting in 2023.

In addition, a study from Mousse et al. (2015) found that higher pre-crisis ROE in banks was correlated with greater risk-taking, resulting in substantial losses during financial crises. In other words, the financial sector, such as banking, with high ROE, can be related to higher risk during crises. While a high ROE is often perceived as a sign of financial health, in the banking sector, it can sometimes reflect higher risk exposure due to practices like increased leverage and reduced capital buffers. Investors and regulators should consider these factors when evaluating the performance and stability of financial institutions.

Based on all those factors, this study found that the most impacted stock sector was the financial sector. According to Bursa Malaysia, the financial sector comprises three subsectors: banking, insurance, and other financial services. According to Bursa Malaysia, the definition of banking is providing a broad range of financial services, including retail banking, loans, and money transmission. In contrast, insurance was defined as insurance companies with products in life, health, property, and casualty insurance takaful. Other financial sectors are companies engaged in financial activities not specified elsewhere, including stock exchanges, securities, asset management companies, and other service providers to financial institutions. To identify high-risk stock while taking all the factors and characteristics of high-risk into account, this study was interested in monitoring high-risk stock in three subsectors of the financial sector in Bursa Malaysia. In conclusion, this study found that the financial sector was the most impacted by macroeconomic factors, sanctions, pandemics, and political issues.

## **METHODOLOGY**

The literature review identified the factors of fluctuation in stock price. Hence, the cause-and-effect diagram, also known as the fishbone diagram, has been created. The duration of data analysis was five years, from 2019 to 2024. This is because it is based on several factors of fluctuation in stock price, which were macroeconomic, pandemic, government changes, and sanctions that occurred and are still ongoing during the five-year period. Figure 1 shows the cause-and-effect diagram for the fluctuation of stock prices in six categories. The six categories are man, materials, maintenance, methods, measurement, and environment.

Figure 1

A Cause-and-Effect (Fishbone) Diagram

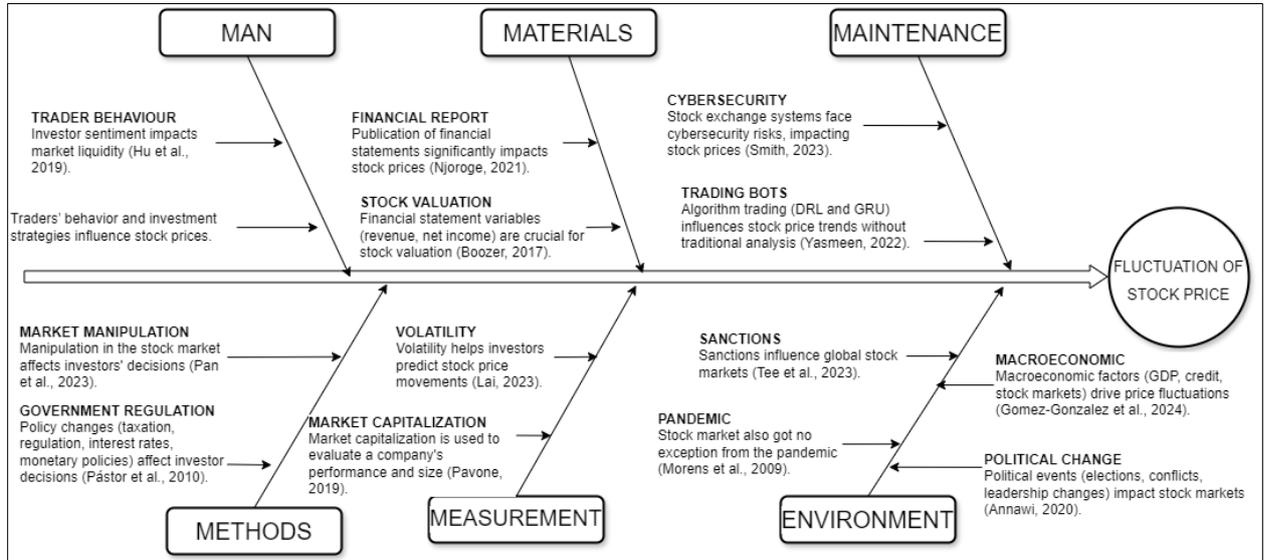


Table 1 shows the count of stocks that have been identified as high-risk stocks based on the ROE and market capitalization. However, in selecting the highest-risk, this study is interested in determining which subsector was the most impacted among these three subsectors.

Table 1

List of Stocks Listed Under the Financial Sector

Stock	ROE (%)	MARKET CAP (MILLION)	HIGH-RISK?	CATEGORY
<u>PBBANK</u>	12.4	88318.65	No	BANKING
<u>CIMB</u>	11.43	88861.18	No	BANKING
<u>MAYBANK</u>	10.74	129116.39	No	BANKING
<u>HLBANK</u>	10.73	46042.34	No	BANKING
<u>HLFG</u>	10.57	21114.31	No	BANKING
<u>AMBANK</u>	9.76	18924	No	BANKING
<u>ABMB</u>	9.73	8204.96	No	BANKING
<u>RHBBANK</u>	9.05	28947.01	No	BANKING
<u>BIMB [s]</u>	7.14	5688.85	No	BANKING
<u>AFFIN</u>	4.4	6793.38	No	BANKING
<u>TAKAFUL [s]</u>	18.93	3043.92	No	INSURANCE
<u>MNRB</u>	15.99	1628.82	No	INSURANCE
<u>LPI</u>	15.58	5537.52	No	INSURANCE
<u>ALLIANZ</u>	13.07	3311.26	No	INSURANCE
<u>MANULFE</u>	7.38	510.05	No	INSURANCE

<u>ALLIANZ-PA</u>	0	3152.74	No	INSURANCE
<u>TUNEPRO</u>	-4.61	218.56	No	INSURANCE
<u>MAA</u>	-5.12	56.7	Yes	INSURANCE
<u>P&amp;O</u>	-24.57	186.57	Yes	INSURANCE
<u>BURSA [s]</u>	35.48	6425.84	No	OTHER FINANCIAL
<u>RCECAP [s]</u>	14.19	1959.5	No	OTHER FINANCIAL
<u>AEONCR</u>	13.22	2900.3	No	OTHER FINANCIAL
<u>WELLCHIP</u>	11.9	654	No	OTHER FINANCIAL
<u>APEX</u>	11.87	196.48	No	OTHER FINANCIAL
<u>EMCC</u>	9.96	373.49	No	OTHER FINANCIAL
<u>PPJACK</u>	9.19	745.15	No	OTHER FINANCIAL
<u>OSKVI</u>	8.75	108.68	No	OTHER FINANCIAL
<u>KENANGA</u>	8.51	728.4	No	OTHER FINANCIAL
<u>HLCAP</u>	8.47	920.92	No	OTHER FINANCIAL
<u>MERSEC</u>	7.8	281.29	No	OTHER FINANCIAL
<u>ELKDESA</u>	7.18	518.48	No	OTHER FINANCIAL
<u>MBSB [s]</u>	5.63	5920.07	No	OTHER FINANCIAL
<u>M&amp;A</u>	3.94	621.23	No	OTHER FINANCIAL
<u>INSAS</u>	3.62	592.9	No	OTHER FINANCIAL
<u>KUCHAI</u>	3.4	87.86	Yes	OTHER FINANCIAL
<u>ECM</u>	1.04	81.72	Yes	OTHER FINANCIAL
<u>AUTORIS</u>	0	186.05	Yes	OTHER FINANCIAL
<u>FINTEC</u>	-7.82	35.87	Yes	OTHER FINANCIAL
<u>JOHAN</u>	-9.18	35.04	Yes	OTHER FINANCIAL

Table 2 summarizes the count of the highest-risk subsector. Thus, this study is interested in monitoring stocks from other financial services. Consequently, the risk matrix can determine which stock has the highest risk in the other financial services subsector.

**Table 2**

*Count of High-Risk Stocks in Each Subsector*

<b>Subsector</b>	<b>Count of high-risk stock</b>
Banking	0
Insurance	2
Other financial	5

To achieve this, Table 3 outlines the risk matrix indicators, using ROE and market capitalization to classify stocks into different risk levels: high-risk, medium-high-risk, and extremely high-risk. Table 3 shows the indicators in using the risk matrix.

**Table 3**

*Indicators for Risk Matrix*

<b>Risk level</b>	<b>ROE</b>	<b>Market capitalization</b>
High-risk	More than 5%	More than RM 200 million
Medium high-risk	Between 0% to 5%	Between RM100 million to RM 200 million
Extremely high-risk	Less than 0%	Less than RM 100 million

Table 3 establishes the indicators used to classify stock risk levels based on two key financial metrics: Return on Equity (ROE) and market capitalization. These indicators serve as the basis for the risk matrix, where stocks are categorized into high-risk, medium-high-risk, or extremely high-risk groups.

Table 4 applies this classification framework, mapping the five identified stocks within the Other Financial Services subsector onto the risk matrix. Using the thresholds defined in Table 3, stocks are positioned according to their risk level, with the lightest blue representing high-risk stocks, the medium blue indicates medium-high risk, and the darkest blue highlights extremely high-risk stocks. Through this approach, FINTEC and JOHAN were identified as the highest-risk stocks in the subsector.

**Table 4**

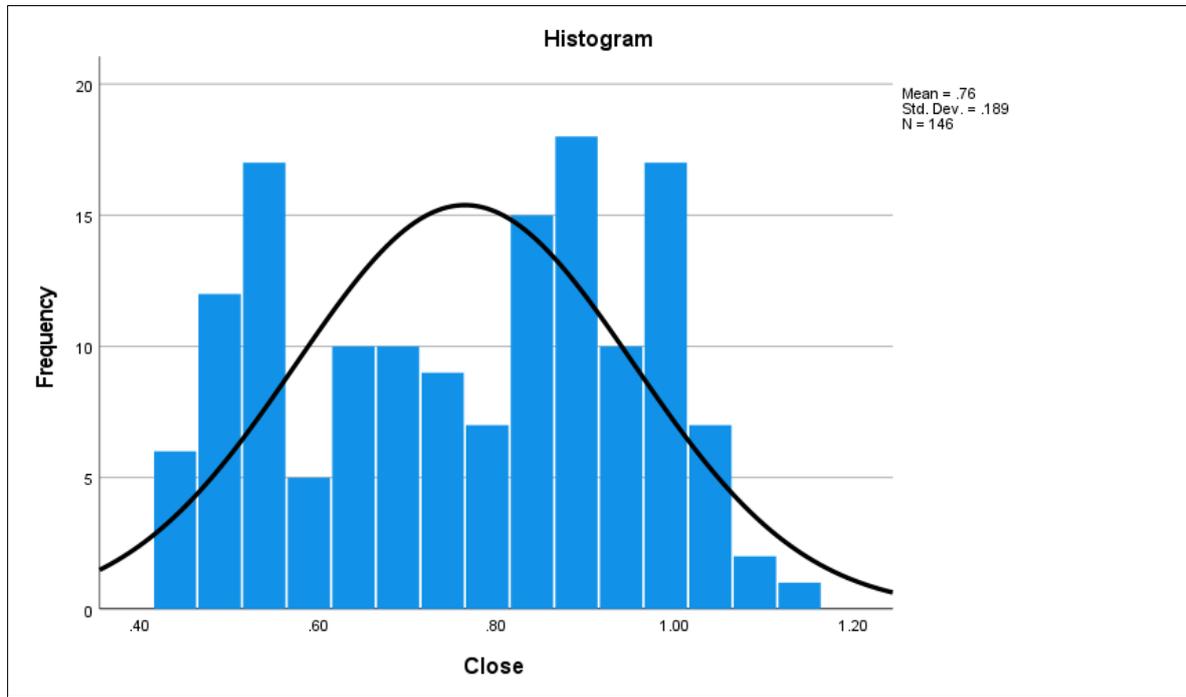
*Risk Matrix*

<b>ROE/ MARKET CAPITALIZATION</b>	High-risk	Medium high-risk	Extremely high-risk
High-risk			
Medium high-risk		AUTORIS	
Extremely high-risk		KUCHAI, ECM	FINTEC, JOHAN

Figures 2 and 3 show the results for descriptive statistics of the close price data. The histogram in Figure 2 indicates that the closing price exhibits a non-normal distribution. Meanwhile, the Q-Q plot in Figure 3 shows that the distribution is non-normal. However, to ensure that the distribution data exhibits non-normality, the skewness and kurtosis of the data were taken. The data showed a skewness of -0.185 and kurtosis of -1.231, indicating that the stock distribution is slightly left-skewed and has lighter tails than a normal distribution.

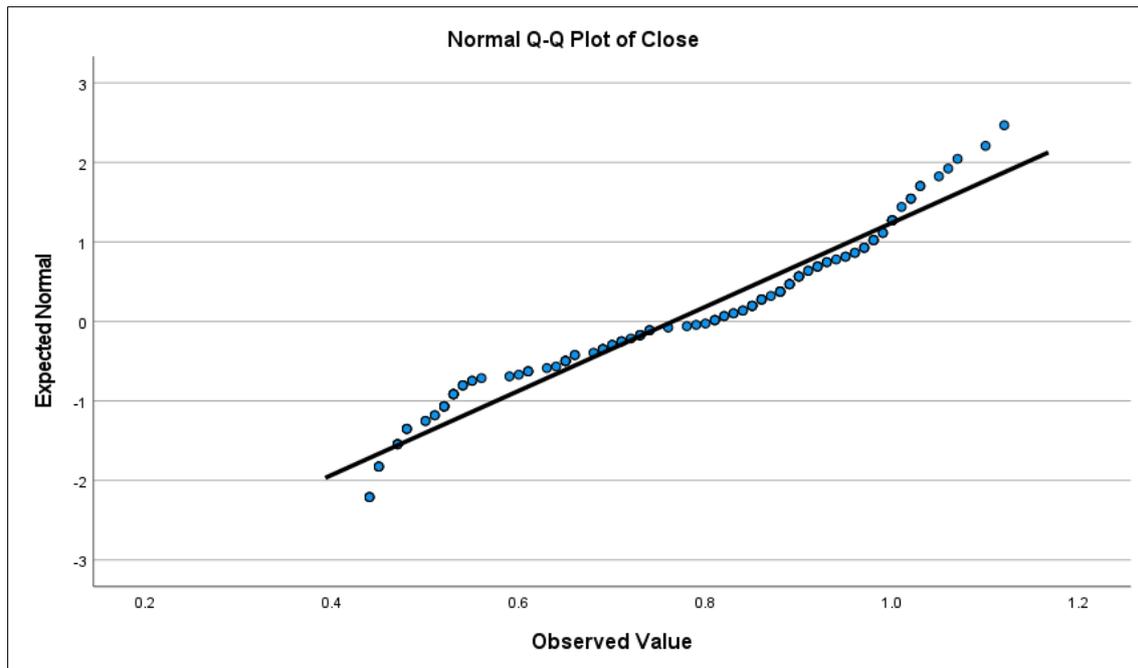
**Figure 2**

*Histogram*



**Figure 3**

*Q-Q plot*



Although the normality test and visual inspection of the data suggested it was approximately normal, stock price data are inherently prone to non-normal behavior, such as heavy tails, skewness, and volatility clustering. These characteristics are well-documented in financial literature and may not always be apparent in small datasets, as smaller samples can mask deviations from normality. Therefore, the use of median CUSUM remains appropriate and relevant, as it provides a more robust monitoring approach by reducing the impact of outliers and accommodating deviations from the normality assumption often observed in stock price data.

### **CUSUM chart formula**

The method of analysis is by using the daily close prices and the median as variables in the CUSUM chart.

Compute the daily close price using the formula in Equation 1.

$$y_i = \frac{x_i - \mu}{\sigma} \quad (1)$$

where  $x_i$  is the stock price at time  $i$  and  $\mu$  is estimated using the sample mean, and  $\sigma$  is the estimated sample standard deviation.

The formula for calculating the sample mean,  $\bar{x}$  and sample standard deviation,  $s$  are shown in Equations 2 and 3, respectively.

$$\bar{x} = \frac{\sum x}{n} \quad (2)$$

$$s = \sqrt{\frac{\sum(x - \bar{x})^2}{n - 1}} \quad (3)$$

where  $x$  is the close price and  $n$  is the total number of samples.

However, this study proposes to use the median in place of the mean. Therefore, the median formula given in Equation 4 is shown as follows:

$$\tilde{x} = \begin{cases} \left[ \frac{(n+1)}{2} \right]^{th}, & n \text{ is odd} \\ \frac{\left[ \frac{n}{2} \right]^{th} + \left[ \frac{n}{2} + 1 \right]^{th}}{2}, & n \text{ is even} \end{cases} \quad (4)$$

In addition, by replacing the mean with the median, the sample standard deviation becomes unsuitable. Therefore, this study proposes using the median absolute deviation as an alternative estimator for standard deviation with the formula in Equation 5.

$$MAD = \text{median}(|x_i - \tilde{x}|) \quad (5)$$

Next, in creating a median CUSUM control chart. The formula for the control limit in plotting a control chart is as follows:

CUSUM values for upward shift in Equation 6.

$$C_i^+ = \max(0, C_{i-1}^+ + y_i - k) \tag{6}$$

Where  $i = 1, 2, \dots, t$  and  $k$  is the reference value of 0.5 (Montgomery, 2008)

An upward shift is detected as soon as the following inequality holds:  $C_i \geq h$

where  $h$  is the threshold value of 4.774.

CUSUM values for the downward shift in Equation 7.

$$C_i^- = \max(0, C_{i-1}^- + y_i - k) \tag{7}$$

A downward shift is detected as soon as  $C'_i \leq -h$

By plotting the upper limit of  $h = 4.774$  and lower limit of  $-h = -4.774$  (Montgomery, 2008)

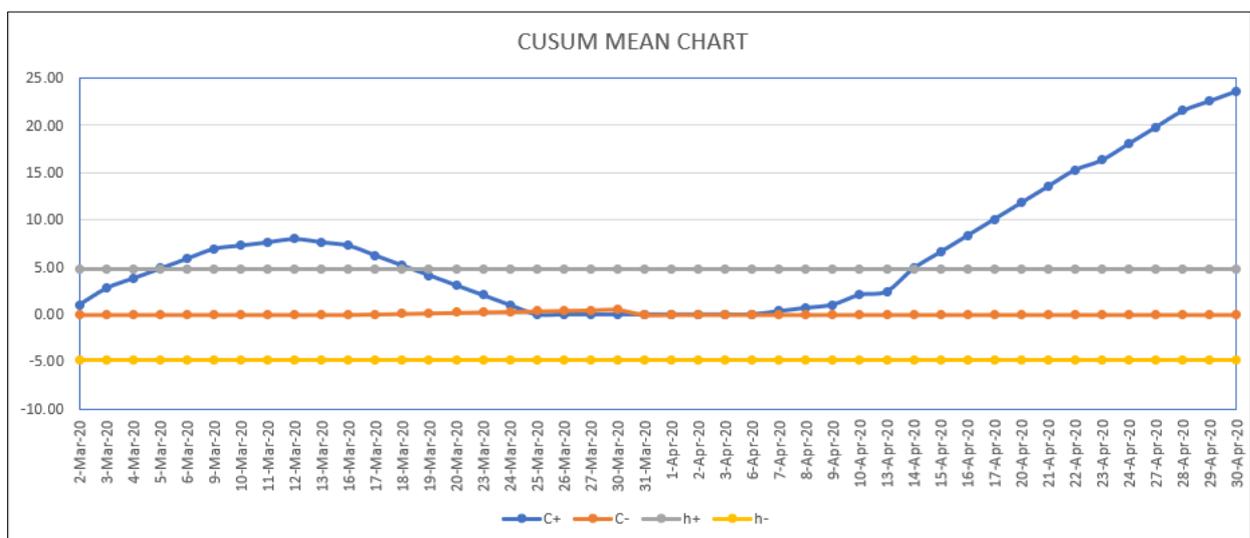
By following these steps, a tabular CUSUM can be created and plotted to detect shifts in stock price trends.

### RESULT AND DISCUSSION

Figure 4 shows the CUSUM mean chart from March 2020 to April 2020. The CUSUM mean chart contains several key lines that help interpret stock price movements.

**Figure 4**

*CUSUM Mean Chart During COVID-19*



The C+ line in blue color represents the cumulative sum of positive deviations from the median, indicating an upward trend. The C-line in orange color represents the cumulative sum of negative deviations from the median, indicating a downward trend. The h+ line in gray and the h- line in yellow represent the upper and lower control limits, respectively. When C+ or C- crosses these control limits, it signals a significant deviation that warrants further investigation.

Before going deeper into the trend analysis, this study took into account the background of the FINTEC GLOBAL BERHAD business to understand its business nature and justification for every movement. FINTEC GLOBAL BERHAD is an investment holding company primarily engaged in providing financial and business advisory services. It also has diverse investments in industries such as technology, biotechnology, and manufacturing. The company operates in a high-risk investment environment, where speculative trading, financial disclosures, and macroeconomic conditions often influence its stock price. Given its nature as an investment holding company, FINTEC’s stock performance is highly sensitive to market sentiment and external economic factors.

Table 5 shows the changes in the CUSUM mean chart over a period of time. During early March, the C+ trend increased upward, indicating that the stock price increased.

**Table 5**

*Analysis of CUSUM Mean Chart*

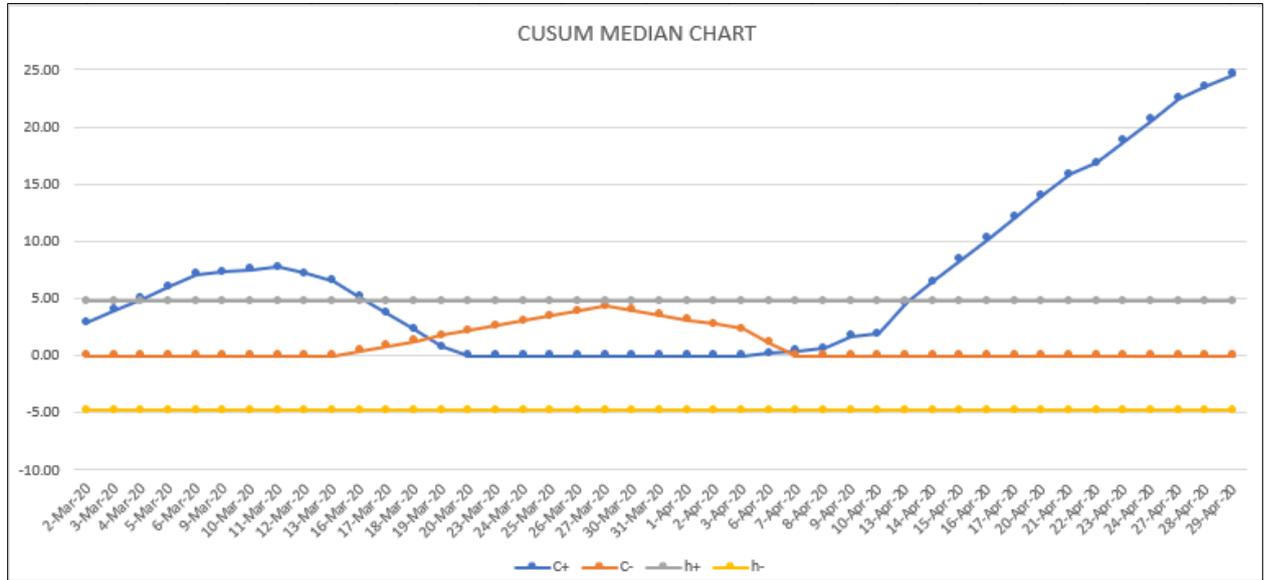
Date range	Stock price	C+	C-
5 – 12 March 2020	Increasing	Increasing	No significant change
13 – 22 March 2020	Decreasing	Decreasing	Slight increase
6 – 13 April 2020	Increasing	Increasing	No significant change
14 – 30 April 2020	Sharply increasing	Strong upward trend	No significant change

On 5 March 2020, FINTEC announced a private placement to raise RM 10 million by issuing new shares. This can trigger a belief among investors in trusting the stock to make an investment. Consequently, investor sentiment affects the stock market demand, increasing the price. In addition, the decreasing trend from 13 March to 22 March 2020 can be the result of the COVID-19 pandemic. The total lockdown was announced on 18 March 2020, causing the market to slow down and the stock price to decrease. At the end of April, the stock price increased due to the recovery from the total lockdown. Due to the business nature of FINTEC, which is an investment company, it attracts traders and investors to invest more due to the high market demand during that period.

Figure 5 shows the CUSUM median chart from March 2020 to April 2020. The CUSUM median chart contains several key lines that help interpret stock price movements.

**Figure 5**

*CUSUM Median Chart During COVID-19*



**Table 6**

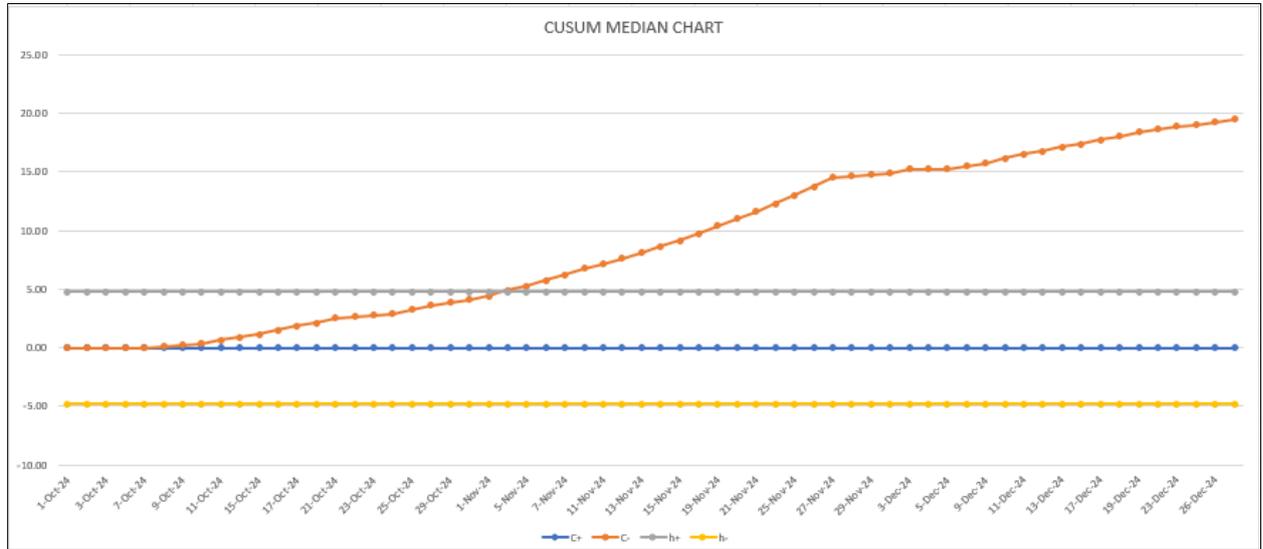
*Analysis of CUSUM Median Chart*

Date range	Stock price	C+	C-
5 – 12 March 2020	Increasing	Increasing	No significant change
13 – 22 March 2020	Decreasing	Decreasing	Increasing
6 – 13 April 2020	Slight increase	Slight increase	No significant change
14 – 30 April 2020	Sharply increasing	Strong upward trend	No significant change

Table 6 shows the changes in the CUSUM median chart over a period of time. The trend shows slightly similar to the CUSUM mean chart, except there was a difference during late March and early April. During this period, there was a total lockdown due to the COVID-19 pandemic. However, the CUSUM mean chart does not capture an accurate trend during the lockdown. The CUSUM median chart shows a huge increasing trend in C- which indicates that the stock price is decreasing.

**Figure 6**

*CUSUM Median Chart After COVID-19*



**Table 7**

*Analysis of CUSUM Median Chart*

Date range	Stock price	C+	C-
2 October – 1 November 2024	Steady decline in stock price	Stable	Continuous upward trend
2 November 2024 – 26 December 2024	Sharp decline initially, then stabilizes	Stable, no significant change	Continues increasing but at a slower pace

Due to more accuracy on the CUSUM median chart, this study monitors FINTEC stock during the post-pandemic period. Table 4 shows the trend movement from October to December 2024. From Table 7, it stated that C- continues to increase, indicating that the stock price was decreasing. Between October and December 2024, FINTEC experienced several significant developments that impacted its financial standing and stock performance. One of the key events during this period was the release of the company’s quarterly financial reports. On 29 November 2024, FINTEC disclosed its financial results for the quarter ending 30 September 2024, and later, on 28 February 2025, the company published earnings for the quarter ending 31 December 2024. These financial reports provided crucial insights into the company’s performance and influenced investor sentiment.

In addition to financial reporting, FINTEC proposed a share capital reduction in December 2024, aiming to eliminate accumulated losses amounting to RM126.8 million. This strategic move was intended to strengthen the company’s financial position by restructuring its capital and improving future financial stability. The proposal reflected management’s efforts to enhance FINTEC’s overall financial health and restore investor confidence. As a result, a risk-averse investor would back off from investing in a risky investment.

## CONCLUSION

This study has provided a comprehensive analysis of high-risk stock, which is FINTEC Global Berhad's stock price performance, focusing on the factors contributing to its fluctuations, the characteristics of high-risk stocks, and the application of statistical tools such as the Median CUSUM chart to monitor price trends. The stock exhibited high volatility, low return on equity (ROE), and small market capitalization, all of which are key indicators of a high-risk stock.

Through the Fishbone diagram, various determinants were identified through the six categories: man, materials, measurement, maintenance, method, and environment. In the man category, this study found that trader behavior and investor sentiment really impact the stock price fluctuation. While in the materials category, financial reports and stock valuation were things that affect the stock price fluctuation. Besides, in the measurement category, the stock's market capitalization and volatility impact the fluctuation of stock prices. Cybersecurity and automated trading fell in the maintenance category, where they were the tools used in stock trading. In the method category, market manipulation and government regulation were found to be factors in the fluctuation in stock prices. Last but not least, macroeconomic, sanctions, pandemic, and political change were under the environment category.

The Median CUSUM chart analysis was instrumental in detecting shifts in stock price trends and cumulative deviations. Due to the normality assumption in the mean CUSUM chart, it does not detect the changes well compared to the median CUSUM chart, which can detect changes well in non-normal data. In March 2024, the CUSUM chart reflected initial upward movements, followed by a decline and subsequent increase, indicating phases of temporary stability and renewed volatility. Meanwhile, from October to December 2024, a more consistent upward trend was observed in the C-statistics, reflecting negative stock performance over the long term. This suggests that despite occasional rebounds, the stock faced underlying weaknesses that prevented sustained growth. The increasing C-trend further indicated continued investor skepticism and declining market confidence in the company's performance.

The analysis of FINTEC's stock behavior over different time periods, particularly the comparison between March and October 2024, highlighted variations in price trends. From the analysis, this study found that investor sentiment, trader behavior, and the pandemic were the factors that impacted variations in price trend. This trend underscores the challenges of reviving low-cap, speculative stocks in a volatile financial environment.

However, one key limitation of this study is that volatility data were not available on Bursa Malaysia, meaning that the assessment of high-risk stocks was based only on market capitalization and return on equity (ROE) instead of the three factors. Since volatility is a key measure of how much a stock's price fluctuates, this limitation may have affected how accurately high-risk stocks were identified.

Last but not least, the findings from this study emphasize the importance of continuous monitoring and robust risk assessment methods when evaluating high-risk stocks. Applying quality management tools like the Fishbone diagram and statistical process control techniques like CUSUM charts can enhance investors' ability to identify early warning signs of financial instability. This is particularly crucial in a market where sudden economic shifts, regulatory changes, or speculative trading can lead to rapid stock price fluctuations.

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## CONFLICT OF INTEREST

The authors declare no conflict of interest.

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