Analyzing The Impact of Technical Malfunctions on The Market Value of Companies: An Event Study on Microsoft Company

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Abstract

Technology systems are an integral part of the accuracy and efficiency of financial reporting in the modern business landscape, and with companies increasingly relying on sophisticated software and digital tools to manage their financial statements, the potential impact of technological malfunctions on stock price has become a major concern.

The study aims to find out the impact of technological system malfunctions on the stock price of companies, with a focus on the case study of Microsoft, in terms of the impact of malfunctions in the company's technological infrastructure on its financial results and the results of other companies that benefit from its services and analyzing the repercussions of these malfunctions on the stock price of those companies.

Through a detailed review of system malfunctions within Microsoft, the study identifies key patterns and impacts on market value. It assesses the extent of these impacts, considering both direct financial consequences and indirect effects on operational efficiency and stakeholder confidence. In addition, the research explores the strategies Microsoft is implementing to address and mitigate the risks associated with technological malfunctions.

The findings highlight the critical importance of strong technology systems in maintaining financial stability and performance, by providing insights into how large corporations manage and recover from technological malfunctions and provide valuable recommendations to enhance system resilience and protect financial integrity.

Keywords: Technical Malfunctions, Stock Prices, Market Value, Microsoft.

تحليل تأثير الأعطال التقنية على القيمة السوقية للشركات: دراسة حدث على شركة ميكروسوفت

مستخلص

تعتبر الأنظمة التقنية جزءًا أساسيًا من دقة وكفاءة التقارير المالية في البيئة التجارية الحديثة، مع اعتماد الشركات المتزايد على البرامج المتقدمة والأدوات الرقمية لإدارة بياناتها المالية، أصبح تأثير الأعطال التقنية على الأداء المالي مصدر قلق متزايد.

تهدف هذه الدراسة إلى استكشاف تأثير أعطال الأنظمة التقنية على القيمة السوقية للشركات، مع التركيز على حالة شركة .Microsoft يتمحور البحث حول كيفية تأثير الأعطال في البنية التحتية التقنية للشركة على القيمة السوقية، من خلال تحليل تذبذب أسعار أسهم Microsoft.

تحدد الدراسة الأنماط والتأثيرات الرئيسية على القيمة السوقية للشركة عبر مراجعة شاملة لحالات فشل النظام داخل .Microsoft كما تُقيّم مدى هذه التأثيرات، مع الأخذ في الاعتبار كل من العواقب المالية المباشرة والآثار غير المباشرة على الكفاءة التشغيلية وثقة أصحاب المصلحة.

تسلط النتائج الضوء على الأهمية البالغة للأنظمة التقنية القوية في الحفاظ على الاستقرار والأداء المالي، وتقدم رؤى حول كيفية إدارة الشركات الكبرى للأعطال التقنية والتعافي منها، كما تقدم الدراسة توصيات قيمة لتعزيز مرونة الأنظمة وحماية السلامة المالية.

الكلمات المفتاحية: الأعطال التقنية، أسعار الأسهم، القيمة السوقية، ميكروسوفت.

I. Introduction

Technology is not only a support tool in the contemporary business environment, but it is a critical element that drives operational efficiency and market value, so companies in various sectors have integrated advanced technological systems to simplify operations, enhance data accuracy and improve decision-making capabilities, this reliance on technology, while providing many advantages, also carries significant risks, especially regarding system malfunctions. Such disruptions can have profound effects on stock prices, potentially affecting everything from day-to-day operations to long-term strategic goals.

Technological malfunctions can range from minor software glitches to major hardware malfunctions, and their consequences can be far-reaching. They can manifest themselves in various forms, including software errors, hardware malfunctions, cyberattacks, and infrastructure outages. These issues can lead to inaccurate financial reporting, operational inefficiencies, and even financial losses and the severity of the impact often depends on the nature of the failure, the importance of the system affected, and the company's ability to respond and recover. For companies like Microsoft, which operate on a global scale and serve millions of customers, even a brief disruption can lead to significant financial losses, reputational damage, and operational setbacks, and understanding these dynamics is critical for organizations aiming to protect their financial performance from technological risks.

This study seeks to delve into the study of technological malfunctions faced by Microsoft and their subsequent effects on the stock price of the company, and the main areas of focus include the direct financial impact of disruptions, such as loss of revenue or increased costs, as well as indirect effects, such as damaging stakeholder confidence and market reputation, and by providing a comprehensive analysis of the interaction between technological system malfunctions and stock price, this study aims to provide valuable insights to both academics and practitioners, and the results will contribute to a deeper understanding of the risks associated with Technological systems and highlighting best practices for managing and mitigating these risks.

II. Problem of the study

On July 19, 2024, cybersecurity company CrowdStrike released an inaccurate update to its Falcon Sensor security software, leading to widespread issues with Microsoft Windows computers using the software. As a result, about 8.5 million systems crashed and were unable to restart properly. The incident has been described as the largest outage in IT history, and "historic in scale."

This outage has disrupted the daily activities of businesses and governments globally. Many industries have been severely affected, including airlines, airports, banks, hotels, hospitals, the manufacturing sector, stock markets, broadcasting, gas stations, and retail stores, as well as government services such as emergency services and websites. The global financial damage caused by this incident has been estimated at least US$10 billion.

Within hours of discovering the error, a recovery update was released, but because it required manually repairing many of the affected computers, outages in many services continued for a long time.

Although previous studies have addressed multiple impacts of technical malfunctions on companies, a deeper understanding of how these malfunctions affect the market value of a company of the size and importance of Microsoft is needed.

This research addresses the problem of analyzing the impact of this imbalance on Microsoft' stock prices. The problem defines the following questions:

Q1: How did the July 19, 2024, technological glitch affect Microsoft' stock prices in the days following the event?

Q2: Did the imbalance lead to abnormal returns, which are higher than expected based on general market movements?

Q3: Are the observed abnormal returns statistically significant, suggesting that the event had a noticeable impact on the stock price beyond normal market volatility?

While previous studies have focused on the impact of technical malfunctions from the perspective of internal operations and operational efficiency, research on the direct impact of these failures on the market value of companies remains limited, especially with regard to large technology companies such as Microsoft. This study aims to fill this gap by conducting an "event study" that examines the impact of specific technology failures on Microsoft's market capitalization, providing a deeper understanding of the financial consequences of these failures and how to manage them effectively.

III. Objectives of the study:

This study aims to achieve the following

- Impact Determination: Measure how technological malfunctions affected the Microsoft' stock price during the event period.
- Abnormal returns analysis: Calculating and analyzing abnormal returns to determine if they are statistically significant and how they compare to natural market returns.
- Understanding the impacts: Provide a comprehensive understanding of how such technological malfunctions affect stock market performance, contributing to broader research on market reactions to operational disruptions.

IV. Importance of the study:

The study is gaining relevance in the context of the growing interest in technology companies and their ability to manage and recover from technological problems. By focusing on Microsoft, the study provides valuable insights that can be generalized to other technology and cybersecurity companies facing similar challenges by providing guides for financial departments on how to hedge against the impact of technical malfunctions on a company's financial performance and will help investors make more informed investment decisions. The study also highlights the relationship between technical malfunctions and changes in the market value of major technology companies such as Microsoft, helping investors and administrators estimate the financial risks associated with such failures.

V. Literature Review

Cavalcante, (2013) aims to identify the impact of new technology on the business models of companies. Three companies from a Danish consortium were selected to study the case. The study results showed that companies will use new technology to extend their existing business models, and technology may represent a platform to create a new business model. This paper helps companies understand the impact of technology from a business model perspective, enabling them to better manage innovation.

Al Ajlouni & Al-Hakim, (2019) aimed to clarify the role of financial technology in the financial industry in general and the banking sector in particular and determine the impact of financial technology. The study discussed the impact of financial technology on the banking sector and the response required to confront it and propose future research and provided proposals for future research on the impact of financial technology on the financial industry and the banking sector in Arabic countries. The study found that fintech presents significant opportunities such as improved access to capital and financial inclusion, but it also carries risks such as intense competition and operational risk. In addition, banks need to update their operating models and adopt new technology to adapt to the challenges posed by financial technology.

Ji et al., (2020) examined the influence of information technology (IT) investment, including innovative IT investment and non-innovative IT investment, on comprehensive enterprise financial performance in a developing country, China. This paper applied the method proposed by Barber and Lyon to construct the control group to study the impact of IT investment on financial performance of enterprises, using a sample of 229 IT investment announcement data of Chinese listed companies between 2011 and 2015. Findings: The analysis of the financial benefits of these IT implementations yields mixed results. The results show that companies investing in IT can significantly improve profitability both the implementation and post-implementation periods for the full sample, improve the solvency only during the implementation phase, improve the growth ability after implementation time and cannot reduce business costs in all periods. At the same time, the authors find that, compared with non-

innovative IT investment, the innovative samples do not achieve better financial performance, except the profitability financial indicator. There are several limitations in this research. First, there is no large sample about the IT investment information data set in China, so this study was compelled to use limited sample data from China; hence, this could lead to errors of too early generalization. Second, the firms in the sample are all in China's listed companies, so this may either not accurately or possibly could reflect the entire environment of developing countries.

Wanalo et al., (2020) indicated that banking sector in Kenya has undergone significant changes due to technological adoption, which has improved the delivery of banking services and increased customer satisfaction. The study showed that technological innovations such as proxy banking and ATMs have a positive impact on the financial performance of banks.

Sakinah et al., (2021) discussed the Small and medium-sized enterprise (SME) mushroom that has problems about financial as well as technical problems. This study aims to improve the SME in technical and non-technical aspects. The study used SIMILAR (state the problem; investigate alternatives; model the system; integrated; and re-evaluate) approaches to develop an integrated project design. They investigated that in practice, there are still many SMEs that have not kept their accounting books and reports properly. The implementation of accounting bookkeeping to provide informative financial reports is still difficult for SMEs. SMEs products that have a guarantee will have a higher selling value than similar products that do not have certification. The study findings found that SMEs need to meet good food production methods for Home Industry (Industri Rumah Tangga/IRT), halal standards and meet food safety aspects. Therefore, it is measured on the object of study which refers to the IRT standard. Measurements are made to measure the incompatibility of the IRT that occurs, then corrections are made based on the mismatch and maintain food safety in the production process. Several alternative solutions that are implemented will provide SMEs results that are by the technical standards of oyster mushrooms' house and are entitled to apply for Good Food Production Method for Home Industry CPPB-IRT) and SAK EMKM certifications.

Mărgărit, (2021) discussed the impact of technological developments, especially financial technology (FinTech), on the financial system. The study found that Fintech benefits include reducing systemic risk, improving credit risk assessment, and facilitating access to financial services. The study found that FinTech risks include cyberattacks, facilitating tax evasion, fraud, and illegal transactions. The article focuses on the importance of central banks understanding the opportunities and threats that fintech brings to ensure financial stability.

Baker et al., (2023) examined the impact of fintech on the performance of commercial banks listed on the Oman Stock Exchange and the Abu Dhabi Securities Exchange. The financial performance of banks was measured by total deposits and net profits. The results showed that fintech has a positive impact on both total deposits and net profits. The study encouraged banks to adopt comprehensive strategies to achieve sustainable development.

Zhang & Aumeboonsuke, (2022) study concerns the practical impact of technological innovation on the performance of companies. By taking 1,166 companies listed in China from 2012 to 2020 as a research sample, the study systematically investigates the impact of technological innovation on enterprise performance and its internal impact mechanism. The results show that technological innovation significantly reduces the performance of companies, and this conclusion remains constant after merger and stability tests. Analysis shows that risk tolerance is an important pathway for the impact of technological innovation on the performance of companies, as technological innovation contributes to reducing performance by improving risk tolerance. Finally, the test of variance related to corporate ownership shows that technological innovation has a significantly stronger negative impact on the performance of non-state-owned enterprises compared to state-owned enterprises.

Sellina & Zed, (2023) study aimed to examine and analyze: (1) the impact of financial knowledge on financial performance, (2) the impact of financial inclusion on financial performance, and (3) the impact of information technology on financial performance. The study sample consists of all accessible SME owners in Bekasi County. In this study, samples were

obtained from 230 participants using the facilitated sample method. This study relied on raw data collected through the distribution of questionnaires. The analysis method was used in this study, which is multiple linear regression analysis using the t-test hypothesis. The test results proved that the variables of financial literacy, financial inclusion, and information technology have an impact on the financial performance of SMEs. The effect of independent variables on the dependent variable was 59.75%, while the remaining 40.25% was explained by other factors not examined in this study.

Talab & Flayyih, (2023) study aimed to determine the impact of Information Technology Governance (ITG) under the control objectives of Information Technology and Related Technologies (COBIT) on financial performance. In addition, the study tried to explore the relationships between the factors under study. To verify the impact of IT, the Intellectual Value-Added Factor (VAIC) approach and the specific Corporate Governance Index were used. The company's performance was evaluated using the Operational Efficiency and Economic Value Added (EVA) ratio. The results showed that there is a high level of IT governance application in banks listed on the Iraq Stock Exchange. We also found the effectiveness of IT governance in the financial performance of banks within the COBIT framework. The results informed practitioners and legislative institutions of the importance of following strong COBIT procedures and enhancing IT effectiveness to achieve better financial performance for companies.

VI. Background and Hypothesis Development

6/1 Background

CrowdStrike develops a suite of corporate security software aimed at protecting computers from cyberattacks. Among these programs, the Falcon Sensor product, which acts as a vulnerability scanner, stands out. This product features the installation of an operating system kernel-level sensor on each computer, allowing it to effectively detect and prevent threats. In addition, CrowdStrike distributes periodic updates to its customers, to ensure that their computers can cope with new threats that may arise.

Falcon Sensor monitors the system at a deep level to make sure there are no threats that could harm the device, while constant updates help maintain effective protection by countering the latest types of attacks. On

July 19, 2024, CrowdStrike distributed an incorrect configuration update to its Falcon Sensor software running on Windows computers and servers. The modification to the configuration file responsible for examining named pipes, named Channel File 291, caused an incorrect read of memory in the Windows sensor client, resulting in an invalid page error (Sharwood, 2024). This update caused devices to enter a reboot state or enter recovery mode. Thousands of Windows devices have encountered a blue screen of death (BSOD) problem when booting, affecting banks, airlines, TV stations, supermarkets, and many other companies around the world. A faulty update from cybersecurity provider CrowdStrike caused affected computers and servers to shut down, forcing them into a recovery restart loop that left devices unable to start properly. The problem is not caused by Microsoft but by a third-party CrowdStrike software, which is widely used by many companies around the world to manage the security of Windows PCs and servers. Most Windows PCs were not affected, with CrowdStrike mainly used by organizations (Crowdstrike, 2024).

CrowdStrike did not provide a way for subscribers to delay the installation of update files. MacOS and Linux computers were not affected, as the file containing the issue was only for Windows, but similar issues affected CrowdStrike Linux distributions in April 2024. CrowdStrike canceled the update, and devices that started after the update was canceled were not affected. (NPR, 2024)

Figure (1): CrowdStrike CRWD

Source: Yahoo Finance

Google reported that the update from CrowdStrike was the cause of the problem. A few hours later, CrowdStrike CEO George Kurtz confirmed that updating the incorrect configuration file was the cause of the problem. He also confirmed that the solution had been deployed and that the problem was not the result of a cyberattack (Cyber Security News, 2024).

The day before the incorrect update, the Azure platform experienced an outage that affected some companies' access to their storage and Microsoft 365 apps in the Mid-US region. Microsoft said the July 19 incident had nothing to do with the CrowdStrike issue, but both incidents added to the problems of affected customers. (Warren, 2024)

Microsoft has confirmed that the Azure service outage was caused by a distributed denial of service-type cyberattack. This came after users began filing complaints on Tuesday about their inability to access several Microsoft services, including Microsoft 365 products such as Office, Outlook and Azure. The incident, which lasted nearly 10 hours, lasted less than two weeks after an update from CrowdStrike caused Microsoft's Windows devices to crash. Among the companies affected by the new outage is Britain's NatWest, according to the BBC. The incident started at approximately 11:45am UTC and was resolved at 19:43pm, according to Microsoft's Azure status history page. According to Microsoft, a "subset of customers may have experienced issues connecting to a subset of Microsoft services globally."

The affected services included Azure App Services, Application Insights, Azure IoT Central, Azure Log Search Alerts, and Azure Policy, as well as the Azure portal itself and "a suite of Microsoft 365 and Microsoft Purview services."

Microsoft says the "initial catalytic event" was a DDoS-type attack, in which attackers fill services by passing in order to stop them. Microsoft describes an "unexpected increase in usage" that has resulted in Azure Front Door and Azure Content Delivery Network components performing below acceptable limits, causing intermittent errors, timeout timings, and delays."

Most companies have protection to prevent the impact of DDoS attacks, but the initial DDoS attack activated the company's protection mechanisms, but a bug in the implementation of defenses "increased the impact of the attack rather than mitigated it," Microsoft admits. The outage appears to be

caused by a DDoS attack—even though Microsoft had protection measures—according to Sean Wright, head of application security at Featurespace. "Similarly to what happened with CrowdStrike a few weeks ago, there seems to have been something wrong with the software used to protect against DDoS attacks," Wright says. Wright explains that this highlights the importance of comprehensive software testing.(Forbes, 2024)

Outages have occurred around the world, reflecting the widespread use of Microsoft's Windows software and CrowdStrike software by global companies in many sectors. At the time of the incident, CrowdStrike reported that it had more than 24,000 customers, including about 60% of Fortune 500 companies and more than half of Fortune 1000 companies. On July 20, Microsoft estimated that 8.5 million devices were affected by the update, accounting for less than 1% of all Windows devices.

Cybersecurity consultant Troy Hunt described the incident as "the biggest technical outage in history," adding: "That's exactly what we were all worried about with the Y2K issue, but it really happened this time." Slate magazine described the incident as "Y2K Lite."(X, 2024)

Elon Musk—CEO of Tesla, X Corp., Neuralink, and SpaceX—posted on platform X that CrowdStrike had been "removed from all of our systems."

Tony Fernandes, CEO of AirAsia, demanded answers and compensation for the millions of dollars he said the company lost during the incident(BERNAMA, 2024). Chinese cybersecurity companies such as 360 Security, QAX and Tencent took advantage of the CrowdStrike incident to promote their own software (SCMP, 2024). The media used the term "digital pandemic" to describe the outage.

Figure (2): Microsoft MSFT
Source: Yahoo Finance

H1: The technological malfunction led to abnormal returns for Microsoft

DownDetector reported an increase in issues across multiple platforms and businesses, including Amazon Web Services, Instagram, eBay, Visa, ADT, and PlentyOfFish. Outages have been reported in several countries around the world, including Australia, New Zealand, India and Japan (Yeo, 2024)

CrowdStrike has released a fix for the issue, but according to insiders, it must be applied separately to each affected device. Computers will require a manual restart in safety mode, which is a major headache for IT departments everywhere.(Plummer, 2024)

After the outage that affected many companies around the world, shares of both Microsoft and CrowdStrike fell. CrowdStrike shares fell more than 11% on July 19, while Microsoft' shares fell by less than 1%. This decline reflects the impact of the incident on investor confidence in the two companies, as the outage led to significant operational problems for companies that rely on their programs. For CrowdStrike, the impact was even greater due to the heavy reliance on its software by many global companies. (WSJ Staff, 2024)

NasdaqGS - Nasdaq Real Time Price • USD

CrowdStrike Holdings, Inc. (CRWD) ☆ Follow Compare

261.47 +5.31 (+2.07%)

As of 10:17 AM EDT. Market Open.

Valuation Measures

	Current	4/30/2024	1/31/2024	10/31/2023	7/31/2023	4/30/2023
Market Cap	62.34B	71.14B	70.75B	42.45B	38.60B	28.46B
Enterprise Value	59.43B	68.46B	68.37B	40.07B	36.47B	26.54B
Trailing P/E	476.17	790.65	--	--	--	--
Forward P/E	63.69	74.63	78.74	49.26	67.11	52.36
PEG Ratio (5yr expected)	1.08	1.27	2.31	1.51	2.12	1.61
Price/Sales	19.19	23.33	24.69	15.91	15.56	12.49
Price/Book	24.59	30.88	34.87	23.09	24.05	19.45
Enterprise Value/Revenue	18.10	22.40	24.01	15.16	14.91	11.84
Enterprise Value/EBITDA	164.59	232.99	409.25	571.89	26.69k	633.79

Figure (2): CrowdStrike Indicators
Source: Yahoo Finance

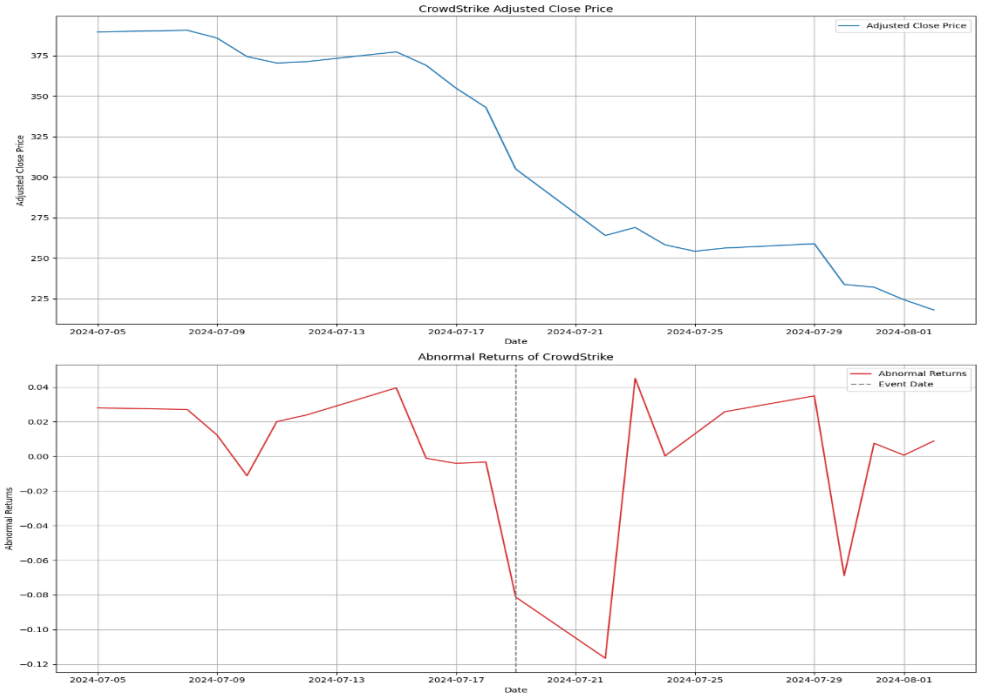

Figure (4): CrowdStrike stock price abnormal returns
Source: the author using Python

Several banks were affected by the outage, including Chase, Bank of America, Wells Fargo, and U.S. Bank, Capital One, and Charles Schwab in the United States; RBC and TD Bank in Canada; Capitec Bank and other banks in South Africa; and several banks in the Philippines such as RCBC, Metrobank, LandBank, BDO, UnionBank, BPI and PNB. E-wallets such as Maya and GCash have also faced problems in the Philippines. The DenizBank website and app were not accessible in Turkey. Visa and several Singaporean companies such as Singapore Exchange (SGX) and DBS Bank have also been affected.(CBC, 2024; Yahoo news, 2024)

H2: The abnormal returns are statistically significant

The London Stock Exchange was operating normally but could not update the news on its website (BBC News, 2024). English gambling company Ladbrokes Coral and supermarket chain Morrisons reported problems. Polish banks, including Santander Bank Polska, ING Bank Śląski and mBank, faced problems due to the outage. Santander BP's hotline, video and chat services were affected. PKO Bank Polski explained that iPKO and IKO services were stable, but other banks faced difficulties. In Finland, OP Financial Group reported minor disruptions in partners' investment and equity savings accounts. Sense Bank in Ukraine encountered outages due to the update(TYP, 2024).

Microsoft immediately launched an in-depth investigation to determine the cause of the error. This included analyzing system logs, reviewing actions, and examining configurations that may have contributed to the issue. Microsoft's technical teams have developed and applied immediate patches to fix the bug. This included software fixes and updates that were necessary to fully restore the service.

VII. Methodology

The event study approach was used to illustrate the procedures and techniques used to analyze the impact of a specific event on a company's stock prices. This section will detail the steps taken to conduct the event study, including event selection, event window, estimation window, data collection, calculation of returns, estimation of expected returns, calculation of abnormal returns, and statistical tests.

7/1. Event Definition

Event Selection:

- **Event:** The technological malfunction experienced by Microsoft on July 19, 2024.
- **Rationale:** This event is chosen due to its potential significant impact on Microsoft's operational performance and investor sentiment, thereby affecting its stock price.

7/2. Event Window

Event Window Definition:

- The event window is defined as the period over which the stock price impact of the event is analyzed.
- **Pre-event period:** 15 trading days before the event.
- **Post-event period:** 15 trading days after the event.
- **Total event window:** 31 trading days (including the event day).

7/3. Estimation Window

Estimation Window Definition:

- The estimation window is the period used to estimate the normal (expected) returns of the stock.
- Estimation period: 120 trading days before the event window.

7/4. Data Collection

Data Sources:

➢ Stock Prices: Daily adjusted closing prices of Microsoft.

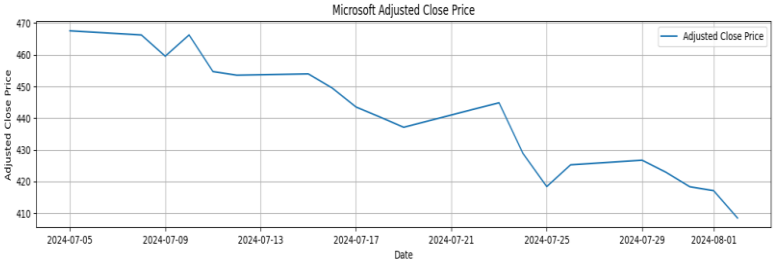

Figure (5): Microsoft Adjusted close price
Source: The Author using python

- Market Index: Daily adjusted closing prices of a relevant market index (e.g., S&P 500).
- Data Period: The data collected spans from 120 trading days before the event window to 15 trading days after the event window.

VIII. Findings and discussion

٨/1/1. Calculation of Returns

Daily Returns Calculation:

- Returns are calculated using the formula:

$$R_{i,t} = \frac{P_{i,t} - P_{i,t-1}}{P_{i,t-1}}$$

Where $R_{i,t}$ is the return of stock i on day t, $P_{i,t}$ is the price of the stock on day $P_{i,t-1}$ is the price of the stock on the previous day.

Table (1)
Daily adjusted closing prices of Microsoft

Date	MSFT_Close	MSFT_Return
2024-07-05	467.559998	0.014736
2024-07-08	466.239990	-0.002823
2024-07-09	459.540009	-0.014370
2024-07-10	466.250000	0.014602
2024-07-11	454.700012	-0.024772
2024-07-12	453.549988	-0.002529
2024-07-15	453.959991	0.000904
2024-07-16	449.519989	-0.009781
2024-07-17	443.519989	-0.013348
2024-07-18	440.369995	-0.007102
2024-07-19	437.109985	-0.007403
2024-07-22	442.940002	0.013338
2024-07-23	444.850006	0.004312
2024-07-24	428.899994	-0.035855
2024-07-25	418.399994	-0.024481
2024-07-26	425.269989	0.016420
2024-07-29	426.730011	0.003433
2024-07-30	422.920013	-0.008928
2024-07-31	418.350006	-0.010806
2024-08-01	417.109985	-0.002964
2024-08-02	408.489990	-0.020666

Source: The Author using python

8/1/2. Estimation of Expected Returns

Market Model:

The market model is used to estimate the expected returns of the stock based on the returns of the market index.

- **Ordinary Least Squares (OLS) Regression:**

$$R_{CRWD,t} = \alpha + \beta R_{M,t} + \epsilon_t$$

Where $R_{CRWD,t}$ is the return of Microsoft on day t, $R_{M,t}$ is the return of the market index on day t, α and β are the regression coefficients, and ϵt is the error term.

Table (2)
Microsoft's (OLS) Regression

Statistic	Value
R-squared	0.485
Adj. R-squared	0.458
F-statistic	17.89
Prob (F-statistic)	0.000453
Log-Likelihood	67.176
AIC	-130.4
BIC	-128.3
No. Observations	21
Df Residuals	19
Df Model	1
Omnibus	1.734
Durbin-Watson	2.340
Prob(Omnibus)	0.420
Jarque-Bera (JB)	1.479
Skew	-0.535
Prob(JB)	0.477
Kurtosis	2.262
Cond. No.	98.9

**	t	<P**	t	std err	coef	V
0.001	0.009-	0.090	1.784-	0.002	0.0041-	const
1.417	0.479	0.000	4.230	0.224	0.9477	SP500_Return

Source: The Author using python

According to the values provided:

- R-squared (coefficient of determination): 0.485
  This means that about 48.5% of the changes in Microsoft's actual earnings can be explained by the actual returns of the S&P 500. This is a moderate level of interpretation, suggesting that the independent variable (the actual returns of the S&P 500) has a noticeable impact on Microsoft's actual earnings per stock, but it is not the only factor influencing.
- Adj. R-squared (adjusted coefficient of determination): 0.458
  The modified coefficient of determination takes into account the number of variables in the model. This shows that the model is still strong after adjusting for the number of variables.
- F-statistic: 17.89
  This value is high and indicates that the model is statistically significant. Which means that the aggregate model that includes the actual returns of the S&P 500 explains a large part of the variation in the actual returns of Microsoft's stock.
- Prob (F-statistic) (probability associated with F statistic): 0.000453
  This value is very low, suggesting that the model is statistically significant. In other words, there is a very small chance that these results came out by chance.
- Log-Likelihood: 67.176
  A value that indicates the model's suitability, and the higher the value, the better the trap.
- AIC (ACAIC Standard Information): -130.4
  A standard used to compare different models, and the lower the value, the better the model.
- BIC (Bizie Standard): -128.3
  Similar to the AIC standard, and is used for the same purpose. Lower values indicate better models.
- Parameters of the form:
  Const (fixed): -0.0041
  This is the stator of the model, and a negative value indicates a slight decline in Microsoft's stock returns when the S&P 500 index yields are zero.

SP500_Return (S&P 500 Yield): 0.9477

This value indicates that for every unit change in the S&P 500 yield, Microsoft's EPS is expected to change by about 0.9477 units. This relationship is positive and statistically strong (p-value < 0.05).

Residue tests:

- Omnibus: 1.734

  A test that measures the compatibility of the actual distribution of residues with the normal distribution.
- Durbin-Watson: 2.340

  A test that measures the extent to which there is self-correlation between the remainders of the model. Values close to 2 indicate no self-correlation.
- Prob (Omnibus): 0.420

  The probability associated with the Omnibus test, and the high value indicate that the residues follow the normal distribution.
- Jarque-Bera (JB): 1.479

  Another test for the compatibility of residues with normal distribution.
- Skew (torsion): -0.535

  A measure of asymmetry in the distribution of residues.
- Prob (JB): 0.477

  The probability associated with the Jarque-Bera test, and the high value indicate that the residues follow a normal distribution.
- Kurtosis (flattening): 2.262

  A measure of how well the distribution of residues overlaps with the normal distribution.
- Cond. No (condition number): 98.9

  A measure that reflects how model variables affect each other. High values indicate problems with multiple lines.

8/1/3 Calculation of Abnormal Returns

- **Abnormal Returns (AR):**

  Abnormal returns are calculated as the difference between the actual returns and the expected returns:

$$AR_t = R_{CRWD,t} - \hat{R}_{CRWD,t}$$

Where $\hat{R}_{CRWD,t}$ is the expected return of Microsoft on day t as estimated from the market model.

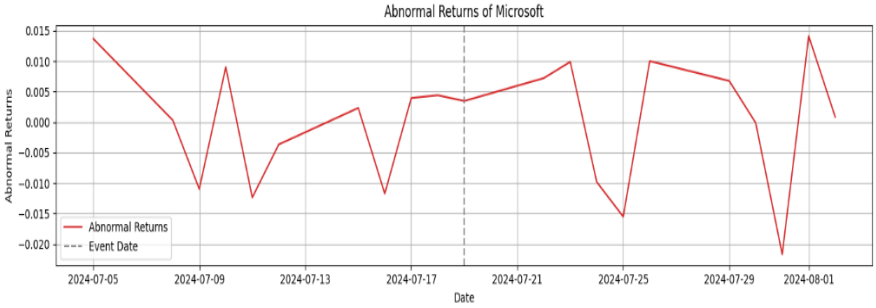

Figure (6): Microsoft abnormal returns
Source: The Author using Python

Table (3)
Abnormal Returns

Date	Expected_Return	Abnormal_Return
2024-07-05	0.001070	0.013666
2024-07-08	-0.003130	0.000307
2024-07-09	-0.003391	-0.010979
2024-07-10	0.005580	0.009021
2024-07-11	-0.012398	-0.012374
2024-07-12	0.001135	-0.003664
2024-07-15	-0.001415	0.002319
2024-07-16	0.001962	-0.011742
2024-07-17	-0.017292	0.003944
2024-07-18	-0.011501	0.004398
2024-07-19	-0.010860	0.003457
2024-07-22	0.006134	0.007204
2024-07-23	-0.005570	0.009882
2024-07-24	-0.026031	-0.009824
2024-07-25	-0.008967	-0.015514
2024-07-26	0.006417	0.010003
2024-07-29	-0.003323	0.006756
2024-07-30	-0.008794	-0.000134
2024-07-31	0.010873	-0.021679
2024-08-01	-0.017070	0.014106
2024-08-02	-0.021513	0.000847

Statistic	Value
Mean Abnormal Returns	0.0002
t-statistic	0.0433
p-value	0.9664

Source: The Author using Python

- **Cumulative Abnormal Returns (CAR):**
  Cumulative abnormal returns over the event window are calculated as:

$$CAR_{t_1,t_2} = \sum_{t=t_1}^{t_2} AR_t$$

where t1and t2 define the start and end of the event window.

Table (4)
Cumulative Abnormal Returns

Date	CAR
2024-07-05	0.013666
2024-07-08	0.013973
2024-07-09	0.002993
2024-07-10	0.012015
2024-07-11	-0.000359
2024-07-12	-0.004023
2024-07-15	-0.001704
2024-07-16	-0.013447
2024-07-17	-0.009502
2024-07-18	-0.005104
2024-07-19	-0.001646
2024-07-22	0.005557
2024-07-23	0.015440
2024-07-24	0.005616
2024-07-25	-0.009899
2024-07-26	0.000105
2024-07-29	0.006860
2024-07-30	0.006726
2024-07-31	-0.014953
2024-08-01	-0.000847
2024-08-02	-0.000000

Source: The Author using Python

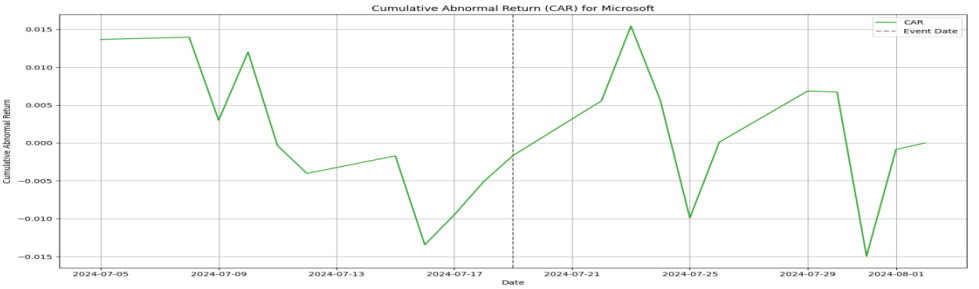

Figure (7): Microsoft Cumulative Abnormal Returns
Source: The Author using Python

According to the previous results daily changes in abnormal yields are:

- Data shows marked fluctuations in abnormal returns. For example, on July 25, 2024, there was a significant decrease in abnormal yields (-0.015514), while on July 23, 2024, there was a noticeable rise (0.009882).
- There is no consistent trend in abnormal yields, as they change dramatically from day to day.

Cumulative abnormal returns (CAR) Results:

- Highest CAR value: Data shows the highest CAR value on July 22, 2024 (0.005557), indicating the accumulation of positive abnormal returns up to that point.
- Lowest CAR value: Data shows the lowest CAR value on August 2, 2024 (-5.204170e-18), indicating that abnormal returns were close to zero at the end of the period.

8/1/4. Trend Analysis:

- Data show periods of positive and negative influences. For example, after a period of positive abnormal returns, such as on July 23, followed by a period of significant negative returns such as on July 25.
- Despite significant daily changes, CAR shows that most of the time it returns to levels close to zero, suggesting that the effects of the event were limited.

8/1/5. Interpretation:

- The overall impact of the event appears to have been non-continuous. Although there are significant fluctuations in abnormal yields, the overall impact on the stock appears to fluctuate significantly and fall to near-zero levels at the end of the period.
- Some periods show when abnormal returns have been positive, indicating a period of above-expected performance followed by periods of lower-than-expected performance, reflecting negative effects on the stock.

8/2. Discussion

The main tests of hypotheses:

Ordinary Least Squares (OLS) regression results provide valuable insights into the relationship between Microsoft Corporation (MSFT) returns and the S&P 500. The analysis highlights the degree to which MSFT stock yields are affected by market movements, as well as the importance of abnormal returns during the event window.

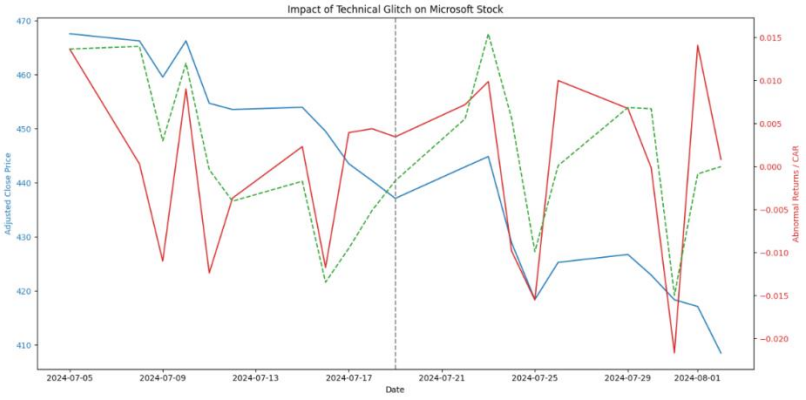

Figure (8): Impact of technical glitch on Microsoft
Source: The Author using Python

Microsoft Corporation (MSFT) ☆ Follow Compare

406.02 +3.33 (+0.83%) **406.69** +0.67 (+0.17%)

At close: August 9 at 4:00 PM EDT After hours: August 9 at 7:59 PM EDT

Valuation Measures

	Current	6/30/2024	3/31/2024	12/31/2023	9/30/2023	6/30/2023
Market Cap	3.02T	3.32T	3.13T	2.79T	2.35T	2.53T
Enterprise Value	3.01T	3.32T	3.13T	2.74T	2.29T	2.49T
Trailing P/E	34.41	38.73	38.04	36.44	32.62	36.89
Forward P/E	30.58	33.33	31.55	33.67	28.65	30.86
PEG Ratio (5yr expected)	2.19	2.20	2.13	2.24	2.33	2.51
Price/Sales	12.37	14.11	13.80	12.86	11.13	12.27
Price/Book	11.24	13.12	13.12	12.66	11.38	13.00
Enterprise Value/Revenue	12.28	14.04	13.77	12.53	10.83	11.98
Enterprise Value/EBITDA	22.63	26.00	25.91	24.43	21.82	24.62

Figure (9): Microsoft indicators
Source: Yahoo Finance

- R-squared and Model Fit:

The R square (0.485) indicates that approximately 48.5% of the variation in MSFT returns can be explained by S&P 500 returns. This suggests a fairly strong correlation between the two variables, which means that almost half of MSFT's performance can be attributed to overall market movements.

The adjusted R square (0.458), which represents the number of forecasters in the model, is slightly lower but still indicates a strong fit.

- Statistical significance of the model:

The statistics of F (17.89) and the associated p-value (0.000453) indicate that the total regression model is statistically significant. This means that the S&P 500 returns are an important indicator of MSFT returns, rejecting the null hypothesis that the regression model has no explanatory power.

- Coefficients and Their Interpretation:

The constant (intercept) -0.0041 indicates that when the returns of the S&P 500 are zero, the expected return of MSFT is slightly negative. However, this intersection is not statistically significant at the level of 5% (value p = 0.090), which suggests that it may not differ significantly from zero.

The S&P 500 yield coefficient (0.9477) is positive and statistically significant (value p = 0.000), showing that MSFT yields move approximately one-to-one with S&P 500. Specifically, the 1% increase in the S&P 500 is associated with a 0.9477% increase in MSFT yields, reflecting a strong positive correlation.

- Residual diagnosis:

Omnibus (1.734) and Jarque-Bera (1.479) tests indicate that the remains are almost naturally distributed, supporting the validity of the OLS assumptions.

Durbin-Watson (2.340) indicates that there is no significant autocorrelation in the residues, which enhances the reliability of the regression results.

Skewness (-0.535) and Kurtosis (2.262) further confirm that the residue is fairly symmetrical and has an overflow value close to that of the normal distribution.

- Abnormal returns during the event window:

The average abnormal returns during the event window (0.0002) are very close to zero, and the associated t-statistic (0.0433) and the value p (0.9664) indicate that these abnormal returns are not statistically significant. This suggests that the event in question did not have a significant impact on MSFT stock returns.

- Interpretation and effects:
  - Market Relationship

The results show that MSFT stock returns are closely correlated with the overall market, as represented by the S&P 500. This high correlation suggests that MSFT's performance is strongly influenced by broader market trends rather than company-specific factors alone.

- Abnormal yields:

The absence of statistically significant abnormal returns during the event window indicates that the market did not react unusually to the event. This could mean that the event was either expected, already priced, or simply not large enough to influence investor behavior.

- Reliability of the model:

The regression model itself appears to be well defined, with good overall fit and adherence to OLS regression assumptions, such as normally distributed residues and no self-correlation. This increases confidence in the correctness of the results.

The data suggests that the overall impact of the event on Microsoft's stock was volatile and unstable. While there were periods of positive performance, these effects were offset by negative effects in other periods. In general, the effects seem non-continuous, with CAR returning to near-zero levels after each period of positive or negative impact.

The importance of the regression model (F test):

H1: The technological malfunction led to abnormal returns for Microsoft

Null hypothesis (H_0): The model does not have explanatory power, meaning that the coefficient of the independent variable (S&P 500 returns) is equal to zero.

Alternative hypothesis (H_1): The model has explanatory power, meaning that the coefficient of the independent variable (S&P 500 returns) is not equal to zero.

The F test measures whether the overall regression model is statistically significant. With a p-value of 0.000453, which is well below the standard significance level of 0.05, we reject the null hypothesis. This means that the model, which includes S&P 500 returns as an independent variable, explains much of the variation in MSFT returns. The high F statistic also supports this conclusion, suggesting that the relationship between MSFT returns and S&P 500 returns is statistically significant.

The importance of abnormal returns (t-test):

H2: The abnormal returns are statistically significant

Null hypothesis ($H_{0\ ٢}$): abnormal returns during the event period are zero.

Alternative hypothesis ($H_{٢}$): abnormal returns during the event period are not equal to zero.

Mean abnormal Returns: 0.0002

The t-test for abnormal returns evaluates whether the mean abnormal returns differ significantly from zero. The t-statistic of 0.0433 is very small, and the p-value of 0.9664 is much higher than 0.05. This means rejecting the alternative hypothesis, suggesting that the abnormal returns during the event period are not statistically significant. In other words, the event under study did not result in a significant deviation in MSFT returns than expected based on market movements alone.

Interpretation and effects:

- Importance of the model: The rejection of the null hypothesis in the F test confirms that the S&P 500 returns are a statistically significant indicator of MSFT returns. This suggests that the broader market has a strong influence on Microsoft's share price, which is expected for a large and heavily intertwined company in the market.
- Event impact: The failure to reject the null hypothesis on abnormal returns indicates that the event being studied did not result in a significant deviation from the expected returns. This could mean that the event was already anticipated by the market, was not considered to have much impact by investors, or may have been overtaken by other market factors.
- Insight on the constant: The insignificance of the constant suggests that when market movements are neutral (i.e. when S&P 500 returns are zero), MSFT returns are close to zero as well, with no statistically

significant deviation from the expected return. This is in line with the idea that Microsoft's stock is closely tied to the overall market performance.

The results of hypothesis testing support the strong correlation between MSFT returns and market performance, while indicating that the specific event studied did not generate abnormal returns. These insights are important for investors and analysts, as they emphasize the importance of market trends in influencing Microsoft's share price and show that the event under consideration did not have a significant impact on investor behavior.

IX. Conclusion

The relationship between a technical malfunctions and a company's market value depends on several factors, including the size of the error and the extent to which it affects the company's operations and investor confidence. In some cases, a technical malfunction may lead to a sharp decline in the value of the stock if it has a significant impact on the company's performance or future earnings outlook. However, in other cases, a technical malfunction may not have a material impact on market value if investors consider it an accidental or insignificant event. In this study, the results showed that the technical malfunctions did not significantly affect the market value of the company, which may indicate that investors did not consider the error to have a significant impact on the future of the company because Microsoft company enjoys a high level of trust among investors thanks to its long-term strategy or strong position in the market, though investors may ignored the effects of short-term events, resulting in no significant impact on market capitalization. or that the market only temporarily reacted. The other reason for the company's market value remaining unaffected is that Microsoft’s was not the primary cause of the technical malfunction, coupled with its swift response in providing solutions. Microsoft has reviewed and improved its change management procedures to ensure that future modifications and updates do not lead to similar issues. The company has improved its monitoring and alerting systems to ensure technical issues are detected early and dealt with faster before they affect users. Microsoft provided regular updates to customers affected by the error, apologized and provided information about the actions

it took to correct. The company has evaluated and enhanced security measures to ensure that technical errors do not expose data or systems to risks. The company also has conducted a comprehensive review of its processes and procedures to ensure that similar problems do not recur in the future and improve crisis response. All these measures are aimed to minimize the impact of future technical malfunction and improving the stability and reliability of Microsoft services.

X. Recommendations

Through Microsoft's experience regarding the impact of technical malfunction on the market value of companies, the following recommendations can be made:

1- Promote technical risk management strategies: Companies must invest in advanced technical risk management systems to identify and address potential errors before they affect business operations and market value.
2- Increase transparency and communication with investors: In the event of technical errors, it is important that the company adopts a clear and transparent communication policy with investors, in which it explains the reasons for the error and the steps that are taken to correct it, which helps maintain market confidence.
3- Develop rapid response plans: Companies must develop and implement rapid response plans for technical emergencies to ensure that problems are addressed quickly and their negative impact on market value is minimized.
4- Periodic financial impact analysis: Companies should conduct periodic analysis to assess the impact of technical errors on financial performance and market value, and benefit from the results to avoid future mistakes.

XI. Future Research

Here are some ideas for future studies related to RegTech (regulatory technology) from an accounting perspective:

1- Analyze the impact of AI on accounting compliance: Study how AI can be used to improve compliance processes in accounting and identify opportunities and challenges that may arise.
2- The Impact of Blockchain on Accounting Transparency: Examine how blockchain technology can enhance transparency in accounting and auditing processes and provide models of how to apply it in accounting practices.
3- Predicting new organizational changes and their impact on accounting practices: Studying how potential changes in regulatory laws and legislation will affect RegTech's accounting applications.
4- Evaluate the effectiveness of RegTech tools in improving risk management: Analyze how RegTech tools can improve financial and accounting risk management, with a focus on how to effectively integrate them into risk management strategies.
5- The impact of machine learning techniques on financial and accounting forecasts: Study how machine learning techniques can be used to improve the accuracy of financial and accounting forecasts and assess their impact on decision-making.

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