

The Coefficient of Variation (CV) as a Descriptive Measure of Relative Dispersion in Cash Flows : A Comparative Analysis of Cash Flow Stability in Apple and Microsoft (2015–2025)

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Abstract:

This study investigates the patterns of cash flow variability and stability in Apple and Microsoft over the period 2015–2025, with the aim of providing a more accurate interpretation of financial dynamics beyond absolute cash flow magnitudes. The analysis is based on a descriptive and quantitative approach, using operating, net, and free cash flow data extracted from the companies' annual financial statements.

The Coefficient of Variation (CV) is employed as a descriptive statistical measure to assess relative dispersion in cash flows and to enable comparison between firms of different sizes. However, the study explicitly recognizes the methodological limitations of CV, as it captures total variability without distinguishing between positive and negative deviations and does not provide a direct probabilistic measure of financial risk.

To address this limitation, the analysis is complemented by the concept of Cash-Flow at Risk (CFaR), which provides a downside-oriented probabilistic perspective on potential declines in cash flows. This combined approach allows for a clearer distinction between volatility and risk and enhances the robustness of the analytical framework.

The findings indicate that Apple exhibits relatively lower dispersion in operating and free cash flows compared to Microsoft over the full period, suggesting higher stability in cash generation. In contrast, Microsoft shows greater variability, particularly in net cash flows, largely influenced by financing activities and structural shifts over time.

These results, however, remain descriptive in nature and should not be interpreted as definitive measures of financial risk without considering probabilistic and contextual factors.

Accordingly, the study concludes that the Coefficient of Variation serves as a useful preliminary indicator of relative cash flow variability, but its interpretation must be carefully contextualized and supported by additional probabilistic measures when assessing financial risk.

Keywords : cash flows, financial risk, coefficient of variation, liquidity stability, relative volatility.

JEL Classification Codes : C46 ; G33 ; M40.

1. INTRODUCTION

In recent years, there has been growing interest in cash flow analysis as one of the most important indicators of financial stability and risk facing institutions, especially in an economic environment characterized by uncertainty and high volatility. Unlike traditional accounting indicators, cash flows reflect an institution's real ability to generate liquidity, meet its operational and financial obligations, and ensure its short- and long-term viability. However, these flows are not stable, but are subject to

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fluctuations resulting from the nature of the activity, business cycles, and investment and financing decisions, making the analysis of their risks a fundamental issue in modern financial management.

In this context, there is a need to use quantitative tools that can measure the degree of cash flow volatility and compare it to its average level, allowing for a more accurate assessment of the associated risks.

The Coefficient of Variation (CV) is a descriptive statistical measure that enables the assessment of the relative variability of cash flows by relating the standard deviation to the mean of the series. However, its analytical significance remains contingent upon the nature of the data and the level of the arithmetic mean, which necessitates its cautious application within a broader framework of financial risk analysis. By studying the case of Apple and Microsoft during the period 2015–2025, thereby linking quantitative analysis and financial risk in a clear practical framework.

1.1 Main issue:

The following main question can be asked:

What are the patterns and dynamics of cash flow volatility and stability in Apple and Microsoft over the period 2015–2025, and how can relative dispersion measures—particularly the Coefficient of Variation—be used as descriptive Tools within a broader probabilistic framework for assessing cash flow risk?

1.2 Sub-questions:

To answer the main question, the following sub-questions are posed:

1. What is the degree of relative volatility in the operating cash flows (OCF) of Apple and Microsoft, and what does it mean in terms of operational risk during the study period?
2. To what extent does the coefficient of variation (CV) reflect the difference in the level of net cash flow risk between the two companies?
3. Does the degree of risk associated with free cash flow (FCF) differ between Apple and Microsoft, and what is the impact of this on the financing capacity of each company?

1.3 Study hypotheses:

To answer the above sub-questions, the following hypotheses were formulated:

- H1: Apple exhibits lower relative dispersion in operating cash flows compared to Microsoft, indicating higher cash flow stability.
- H2: Microsoft shows greater variability in net cash flows, reflecting higher exposure to financing-induced volatility rather than purely operational risk.
- H3: Apple demonstrates more stable free cash flows, implying stronger internal financing capacity under lower variability conditions.

1.4 Significance of the study:

The significance of this study stems from its treatment of cash flow risk using a simple and effective quantitative tool, namely the coefficient of variation (CV), as an indicator that reflects the degree of relative volatility and monetary instability. The study gains its scientific importance through its contribution to enriching the literature that links cash flow analysis and financial risk, with a focus on measuring risk from the

perspective of liquidity and cash sustainability, and not only from the angle of accounting profitability.

On the practical level, the study is important in that it provides a practical framework that helps financial managers and investors assess cash flow stability and compare institutions of different sizes, thereby supporting more rational decisions regarding financing, investment, and liquidity management. The importance of the study is also highlighted by its application to two global companies (Apple and Microsoft), which gives its results greater applicability and comparative analysis.

1.5 Study objectives:

This study aims to achieve a set of objectives, which can be summarized as follows:

1. Analyse the nature of cash flows for Apple and Microsoft during the period 2015–2025, focusing on operating cash flows, free cash flows, and net cash flows.
2. To measure the relative volatility of these cash flows using the coefficient of variation (CV) and interpret its significance in terms of cash stability and financial risk.
3. To conduct a quantitative comparison between the two companies in terms of cash flow risk, regardless of differences in size or average levels.
4. Evaluate the effectiveness of the CV model as a strategic tool in cash flow risk analysis and financial decision support within the organisation.

1.6 Limitations of the study:

The limitations of this study are defined in several methodological, temporal and thematic aspects. In terms of time, the study is limited to the period from 2015 to 2025. In terms of subject matter, it is limited to the analysis of operating cash flows, net cash flows, and free cash flows, without expanding on other financial indicators. Methodologically, the study relies on the coefficient of variation (CV) as the main measure of volatility and risk, without including more complex models such as simulation models or downside risk measures. The sample is also limited to only two companies, which may limit the possibility of generalizing the results to all sectors or economic

2. Theoretical part of the study:

Cash flows form the basis for assessing an institution's financial risks, primarily liquidity and insolvency risks. Fluctuations in net operating cash flows are an early indicator of instability, requiring the use of advanced quantitative models. These models rely on cash flow data as key inputs. This quantitative approach aims to measure the degree of exposure and determine the relationship between the amount and timing of cash flows and the probability of risk occurrence, thereby increasing the accuracy of appropriate decision-making.

2.1 Conceptual approach to cash flows and their importance in financial management :

Cash flows are the most reliable and effective measurement tool for assessing an institution's financial health and its ability to achieve sustainability. Their pivotal role in

financial management is reflected in providing a basis for analysis and strategic decision-making. They enable management to forecast future liquidity needs on the one hand, and to determine the extent to which operational activities can generate sufficient cash to service debt and finance capital expansions on the other. Monitoring these flows ensures optimal efficiency in working capital management and avoids the risk of bankruptcy or temporary liquidity shortages, confirming its great importance as a basis for comprehensive financial evaluation.

2.1.1 Concept and types of cash flows :

Financial statements are considered among the most important forms of financial disclosure, and their preparation takes into account the Generally Accepted Accounting Principles (GAAP). These statements include : the Statement of Financial Position, the Income Statement, the Statement of Changes in Financial Position, the Statement of Distributed Profits (Dividends), and the Cash-Flow Statement. (benseddik, 2021, p. 220)

The cash flow statement is defined as one of the basic financial statements adopted by the organization, which aims to clarify how cash is generated, obtained and used during a specific period of time. This statement is a tool for assessing the company's financial position and judging the efficiency of its management performance. (Al-Alaf, Al-Murad, & Yaseen, 2025, p. 402)

Cash flow is a key focus of financial analysis, as it provides clear indicators of an organization's liquidity, operational efficiency and financial capacity. Cash flows are divided into three main areas: operating activities, investing activities, and financing activities, each of which provides a different perspective that illustrates a specific aspect of the institution's financial performance and strategic options. According to the International Accounting Standard (IAS 7 , 2009), cash flows from operating activities represent the main activities that generate revenue for the entity, in addition to any other activities that do not fall within investing or financing activities. Operating cash flows can be presented using one of two methods: the direct method, which is the most common, or the indirect method.

Cash flows related to income tax are classified as operating activities unless they can be directly linked to investing or financing activities.

Investing cash flows include the acquisition or disposal of long-term assets, as well as other investments that are not part of cash equivalents.

Financing cash flows are related to activities that result in a change in the size or structure of an entity's equity or debt.

Cash flows resulting from the acquisition or loss of control of subsidiaries are presented separately and classified as investing activities. Investing or financing activities that do not require the use of cash are excluded from the cash flow statement and must be disclosed separately in the accompanying notes.

2.1.2 The importance of cash flow analysis in liquidity management and financial

decision-making :

Cash flows are one of the most important theoretical pillars of financial management, as they are the basis that enables an organization to maintain its financial stability and operational continuity. Cash flow is the 'lifeblood' of an enterprise because of its role in ensuring the availability of liquidity to cover operating expenses and repay short-term liabilities, as well as enhancing the enterprise's ability to cope with economic fluctuations and emergency circumstances. Cash flow management is seen as a dynamic process that aims to regulate inflows and outflows according to the needs of the business, thereby contributing to sustainable cash balance and helping the organization avoid liquidity crises that could threaten its continuity.

The analysis also indicates that cash flows not only affect operational performance, but also play a pivotal role in investment and financing decisions, as rationalizing cash flow management contributes to reducing financing costs, improving resource allocation efficiency, and maximizing the expected return on investment projects. Accurate cash flow forecasting is also a strategic tool in financial planning, as it enables management to identify potential liquidity gaps, prepare balanced financial plans, and enhance the organization's ability to maintain its financial stability in the short and long term. (Wang, 2024, pp. 1-4) .

It can therefore be said that cash flows are a fundamental component in building the conceptual framework for liquidity, financial sustainability, and sound decision-making within organizations.

2.2 Analysis of financial risks associated with cash flows :

The analysis of financial risks associated with cash flows is one of the key elements in assessing the true financial position of an institution, as it reveals the degree of uncertainty surrounding its ability to generate liquidity and maintain its sustainability over time. Unlike accounting profits, cash flows directly reflect an institution's ability to finance its operating activities, meet its obligations, and withstand potential financial shocks. However, these flows are not without risks resulting from fluctuations in economic activity, changes in investment and financing policies, and instability in sources of cash. Therefore, cash flow risk analysis is not limited to measuring its volume, but extends to studying its volatility, regularity, and the likelihood of a sharp decline, allowing for the assessment of liquidity and financial flexibility risks. This element is essential for understanding the nature of the financial risks facing the institution and linking them to the quality of financial decisions made under uncertainty.

From a methodological standpoint, it's essential to distinguish between the concept of volatility and that of risk. Volatility refers to the degree of dispersion around the mean without differentiating between positive and negative deviations, whereas risk is associated with the probability of adverse outcomes or undesirable declines in cash flows. Accordingly, the Coefficient of Variation measures relative volatility and does not, in itself, constitute a probabilistic measure of downside risk. Therefore, it should be

complemented by additional indicators when conducting financial risk analysis.

- X Distinction Between Volatility and Downside Risk:

It is essential to distinguish between volatility and risk. While the Coefficient of Variation captures total dispersion around the mean, risk—particularly in financial contexts—is associated with the probability of adverse outcomes. Therefore, volatility should not be interpreted as a direct proxy for risk. This study addresses this distinction by complementing CV analysis with downside-oriented measures such as CFaR.

2.2.1. Definition of financial risks associated with cash flows:

According to a study by (Kuti, 2011), cash flow risk (CFaR) is defined as the expected level of decline in cash flows that a company may experience during a specific future period, measured within a probability distribution, showing the likelihood of undesirable cash declines. This concept is seen as part of comprehensive corporate risk management, as it helps to identify the likelihood of a decline in cash liquidity and its impact on the company's ability to meet its operational, investment and financing obligations. It is therefore an indicator of liquidity and cash flow risk and is used to assess financial flexibility and make investment and financing decisions in the face of potential cash flow declines.

In a study (Xia, Jairaj, Ziwen, & George, 2023), cash flow risk is used as a key quantitative concept directly related to the volatility of operating cash flows and its impact on the financial position of an organization. Risk is defined here as the fluctuation in expected operating cash flows, measured by the variance or standard deviation of the operating cash flow rate relative to sales or other measures. This measure is used as a predictive variable in models for forecasting financial distress or bankruptcy. The analysis in the study indicates that higher cash flow risk is associated with an increased likelihood of financial shocks and higher cost of capital, which negatively affects a company's ability to meet its operating and financing obligations. In this context, the rate of cash flow volatility is used as a regulator to indicate the financial risk inherent in liquidity instability. This is also linked to variables such as bond yields and yield spreads, reflecting that cash risks are not merely volatility, but have broad implications for the financial health of the company.

2.2.2 The role of risk analysis in improving the quality of financial decisions within an organization :

According to a study (Gasbarro, Miao, Schwebach, & Zumwalt, 2025), financial risk analysis, particularly risks associated with cash flow and liquidity, emerges as an essential tool for improving the quality of financial decisions within an organization. This analysis clarifies for management the nature of uncertainty surrounding future cash flows and helps them align cash retention, investment, and financing decisions with the overall strategy and life cycle of the company. Empirical evidence confirms that organizations that integrate cash risk analysis into their decision-making process achieve higher liquidity efficiency and better risk-adjusted returns, especially when managerial capacity is high.

2.3 Coefficient of variation (CV) model in risk analysis :

The coefficient of variation (CV) model is one of the basic quantitative tools in risk analysis, providing a measure of relative dispersion by relating standard deviation to the mean. This model is used to measure the degree of instability in returns or financial indicators, allowing for comparison between assets or projects that differ in size and value. It is important for its ability to assess risk efficiently, especially in environments characterised by high volatility and financial uncertainty.

2.3.1 The concept of coefficient of variation (CV):

The coefficient of variation is a measure of relative dispersion expressed as the ratio between the standard deviation and the arithmetic mean of a variable and is calculated using the following formula:

$$CV = \frac{\sigma}{\mu}$$

This measure is used to estimate the amount of fluctuation or instability in the data compared to its mean, making it an effective tool for comparing data sets that differ in their measures or mean levels (Jalilibal, Amiri, Castagliola, & Khoo, 2021, p. 4) and (Dodge, 2008).

Interpretation of CV as an indicator for measuring the volatility of financial variables compared to their mean.

According to (NIST, 2017), the coefficient of variation (CV) is defined as the ratio of the standard deviation to the arithmetic mean, and it measures the amount of volatility relative to the mean of the variable, i.e., the relative variation rather than the absolute volatility. Its usefulness is evident when comparing financial variables whose means differ significantly (such as cash flows between companies of varying sizes) because it is an indicator that allows for direct comparison. The higher the coefficient of variation, the higher the relative volatility relative to the mean. However, the coefficient of variation becomes sensitive and misleading when the mean is close to zero.

2.3.2 Justifications for using CV in cash flow risk analysis:

Classic cash flow analysis, as in the use of the coefficient of variation (CV), focuses on measuring the individual volatility of cash flows around their arithmetic mean, as an indicator of liquidity stability and operational or financing risks. A high CV is interpreted as an increase in uncertainty and risk associated with the institution's ability to generate cash, while a low CV reflects relative stability in cash flows. However, despite its practical importance, this perspective remains limited to the analysis of each cash flow individually and implicitly assumes that the relationships between cash flows can be represented by simple linear correlations.

In this context, (Gryglewicz, Mancini, Morellec, Schroth, & Valta, 2022) show that cash flow risk arises not only from the level of apparent volatility, but is also determined by the nature of cash shocks and their degree of correlation over time. While CV measures the relative dispersion of flows around their mean, this argument suggests

that a sustained increase in volatility reflects the company's exposure to more persistent cash shocks, which increases operational and financing risks and influences liquidity and financing decisions. Thus, CV can be considered a simplified practical indicator for measuring one aspect of cash flow risk, while the analysis of cash flow shocks and their correlation provides a deeper framework for interpreting these risks, supporting the quantitative results derived from the coefficient of variation.

2.3.3 Cases of using the CV model in financial analysis and risk management :

The coefficient of variation is used as one of the basic components in the development of advanced risk efficiency measures, such as the Sharpe Ratio, although the Sharpe Ratio uses standard deviation as a risk component and adds risk-free return to the equation. The coefficient of variation is also widely used in evaluating the performance of mutual funds. By comparing the coefficients of variation of two funds operating in the same market sector, an investor can determine which fund is more stable and less prone to violent fluctuations in relation to the return it has achieved. This characteristic makes the coefficient of variation a cornerstone in building balanced and efficiently managed risk portfolios, as it facilitates global comparative decisions between assets denominated in different currencies or with varying price averages (loot, 2025).

3. RESULTS AND DISCUSSION

Cash flows are a key indicator in assessing the financial and operational position of any institution, as they reveal the company's ability to generate cash from its core activities, finance its obligations and sustain its financing policies. Financial data sites such as: www.macrotrends.net. provide a detailed historical record of annual cash data for both Apple and Microsoft for the years 2015–2025, showing cash flows from operations, investment, and financing, as well as net changes in cash. From this perspective, these cash statements provide an objective basis for analyzing relative volatility and structural changes in operating cash flow, free cash flow, and net cash, enabling an assessment of each company's cash stability and operating liquidity risks over the study period.

In Apple's case, annual cash data show steady growth in operating cash flows over the last decade, with relatively limited annual fluctuations in investment and financing activity, reflecting relative stability in operating cash generation and consistency in financing policies, This allows for a reliable quantitative analysis of the relationship between cash flows and financial risk. In contrast, Microsoft's cash records show strong growth in free operating cash flows over the years, driven by superior operating performance and expansionary investment and financing policies, but with greater fluctuations in annual net cash flows as a result of changes in financing activities. This diversity in the cash trends of the two companies provides a vital entry point for the practical aspect of the study, as it allows for a comparison of the degree of volatility and cash risk between the financial indicators of each company during the period 2015–2025.

3.1. Ratios used:

The coefficient of variation (CV) is one of the most important quantitative indicators used to assess liquidity stability and cash flow risk, as it measures the degree of relative fluctuation in cash flows compared to their arithmetic mean. When the CV value is low, this indicates that deviations from the mean are relatively limited, reflecting good monetary stability and a consistent ability to generate liquidity, which translates into low financial risk at both the operational and financing levels. Conversely, high CV values reflect significant fluctuations in cash flows compared to their average, indicating relative weakness in monetary stability and a high level of uncertainty, particularly with regard to future liquidity and shock absorption capacity. Therefore, CV is used as an effective analytical indicator to distinguish between institutions with stable cash flows and those exposed to higher cash risks, provided that it is interpreted in light of the average level and nature of economic activity. Thus, both of the following will be calculated:

3.1.1. The arithmetic mean of the three flows: Operating Cash Flow/Net Cash Flow/Free Cash Flow (FCF)

As follows Mathematical formula: $\text{Mean} = \frac{\sum_{i=1}^n X_i}{n}$

The standard deviation of the same series

The coefficient of variation CV is calculated using the formula: $\text{CV} = \frac{\text{Standard Deviation}}{\text{Mean}}$

3.2. Data collection and analysis for Apple

Apple Inc. is one of the largest global companies in terms of market value and cash flow volume, making it a typical case for quantitative analysis of cash flows in the context of assessing financial stability and cash risks. The practical aspect of this company is based on the analysis of cash flow data contained in the annual financial statements, with a focus on operating cash flows, free cash flows, and net cash flows for the period 2015–2025. This analysis aims to monitor the evolution of the company's ability to generate liquidity from its core activities and to measure the degree of volatility of these flows compared to their historical average, thereby enabling an assessment of the level of monetary stability and the associated risks. This preliminary stage constitutes a necessary methodological basis before moving on to the data collection and statistical processing stage, ensuring that the results are interpreted in light of Apple's financial and structural characteristics.

3.3. Methodological Framework and Statistical Approach:

In order to overcome the limitations of purely descriptive analysis, the study integrates inferential and probabilistic elements. In addition to the Coefficient of Variation, the analysis incorporates the concept of Cash-Flow at Risk (CFaR) as a downside risk measure. Furthermore, statistical inference is introduced through confidence intervals and comparative significance testing of mean differences, allowing the results to move beyond descriptive interpretation toward statistically supported

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conclusions.

Table 01: Historical data on Apple's operating cash flow, net cash flow and free cash flow for the period 2015–2025

Unit: Million USD

Year	Operating Cash Flow	Net Cash Flow	Free Cash Flow (FCF)	Deviation OCF
2015	81.266	26.847	68.532	-10.04
2016	65.121	45.917	52.67	-26.18
2017	63.998	52.164	51.547	-27.31
2018	77.434	55.045	64.121	-13.87
2019	69.391	45.896	58.896	-21.91
2020	80.674	38.163	73.365	-10.63
2021	104.038	104.414	92.953	12.73
2022	122.151	111.443	111.443	30.85
2023	110.543	58.287	100.231	19.24
2024	118.254	61.2	107.254	26.95
2025	111.482	59	99.982	20.18

Source: Prepared by researchers based on (Apple , 2025)

The data in Table 1 shows negative values for operating cash flow deviation during the period 2015–2020 for the company, indicating that OCF was below its historical average, reflecting relatively high volatility in the company's ability to generate cash. When calculating the coefficient of variation (CV), the recurrence of these negative deviations and their high absolute values contribute to an increase in the standard deviation compared to the average, indicating a relative decline in cash flow stability during this period. Conversely, the shift of deviations to high positive values after 2021 indicates a structural improvement in the level of cash flows, which is reflected in a decrease in the relative coefficient of variation and an improvement in the quality of operating cash flows.

Table 2: shows Apple's coefficient of variation calculation based on the three cash flows.

Metric	Mean	Std Dev	CV
Operating Cash Flow	91.30	22.21	24.33%
Net Cash Flow	59.85	25.85	43.19%
Free Cash Flow (FCF)	80.09	22.67	28.30%

Source: Prepared by researchers based on the results in Table No. 01

Analysis of results:

The calculations in Table 2 show that the coefficient of variation for operating cash flow was 24.33% during the total period, compared to 28.30% for free cash flow and 43.19% for net cash flow, indicating that OCF is relatively more stable. When dividing the period into two phases, the CV for operating cash flows decreased from 10.67% (2015–2020) to 6.23% (2021–2025), reflecting a structural improvement in the stability of cash generation. The negative values in the deviation column correspond to years in which OCF was below its historical average, contributing to higher dispersion around the mean. However, the shift to positive deviations after 2021 coincides with a rise in

OCF and a decline in its relative volatility, which explains the apparent decline in CV in the second phase.

3.4. Data collection and analysis for Microsoft

Microsoft represents a unique analytical case for studying cash flow behaviour in fast-growing technology companies, given the structural changes in its operating and investment activities over the last decade. The practical aspect of this company focuses on analysing cash flow data extracted from annual financial statements, particularly operating cash flows and free cash flows. Net cash flows during the period 2015–2025. This analysis aims to assess the degree of stability of liquidity generated from core operations and to reveal the nature of volatility associated with investment and financing decisions, in light of an expansionary strategy based on innovation and acquisition. This section provides a methodological introduction to the data collection and quantitative analysis phase, allowing the statistical results to be linked to Microsoft's financial and strategic context and the associated cash risks to be interpreted with scientific accuracy.

Table 3: Historical data on Microsoft's operating cash flow, net cash flow and free cash flow for the period 2015–2025

Unit: Million USD

Year	Operating Cash Flow	Net Cash Flow	Free Cash Flow (FCF)	Deviation OCF
2015	29.668	-3.074	23.724	-40.09
2016	33.325	0.915	24.982	-36.43
2017	39.507	1.153	31.378	-30.25
2018	43.884	4.283	32.252	-25.87
2019	52.185	-0.59	38.26	-17.57
2020	60.675	2.22	45.234	-9.08
2021	76.74	0.648	56.118	6.98
2022	89.035	-0.293	65.149	19.28
2023	87.582	20.773	59.475	17.83
2024	118.548	-16.389	74.071	48.79
2025	136.162	11.927	71.611	66.41

Source: Prepared by researchers based on: (Microsoft, 2025)

Table 3 shows the evolution of Microsoft's cash flows during the period 2015–2025, with clear quantitative indications of a structural shift in the company's ability to generate cash. Operating cash flow (OCF) has recorded a continuous upward trend, rising from \$29.7 billion in 2015 to more than \$136 billion in 2025, reflecting a fundamental improvement in operating performance and cash generation efficiency from core activities. In contrast, net cash flow (NCF) is characterised by sharp fluctuations and changes in sign between negative and positive values, indicating a strong impact of financing decisions (borrowing, dividends, share buybacks) and limiting its validity as an indicator of cash stability. Free cash flow (FCF), on the other hand, shows a more stable upward trend, reinforcing its significance as an indicator of true financing capacity. Negative deviation values (Deviation OCF) prior to 2021 indicate below-average historical performance, while high positive values thereafter

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reflect a clear structural improvement and relatively higher stability in operating cash flow generation.

Table 4: shows the calculation of the coefficient of variation for Microsoft based on the three cash flows.

Metric	Mean	Std Dev	CV
Operating Cash Flow	69.76	35.27	50.56%
Net Cash Flow	1.96	9.14	466.16%
Free Cash Flow (FCF)	47.48	18.63	39.25%

Source: Prepared by researchers based on the results in Table No. 03

Analysis of results:

The results of the coefficient of variation (CV) show a relatively high fluctuation in the cash flows under study, with the CV for operating cash flows reaching 50.56%, indicating relative instability in the institution's ability to generate cash from its core activities. In contrast, the CV for free cash flows was 39.25%, reflecting a relatively better degree of stability compared to operating cash flows. Net cash flow recorded a very high coefficient of variation of 466.16%, due to the low arithmetic mean and its proximity to zero, which limits the economic significance of CV in this case and reflects the fragility of net cash more than it is an accurate indicator of volatility.

3.5. Detailed comparative analysis of volatility and risk in the cash flows of Apple and Microsoft (2015–2025)

Cash flows are one of the most important indicators of an organisation's financial strength and operational stability, especially when linked to risk analysis. The coefficient of variation (CV) is a quantitative model that allows for comparison of the degree of volatility between companies regardless of their size. Below is a comparative analysis of Apple and Microsoft based on three key cash flow indicators.

Table 5: Summary of relative volatility (CV) and risk level

Company	Variable	$\bar{x}$	σ	CV	Min–Max
Apple	OCF	91.305	22.214	24.33%	63.998 – 122.151
Microsoft	OCF	69.756	35.268	50.56%	29.668 – 136.162
Apple	FCF	80.090	22.666	28.30%	51.547 – 111.443
Microsoft	FCF	47.478	18.633	39.25%	23.724 – 74.071
Apple	Net CF	59.852	25.852	43.19%	26.847 – 111.443
Microsoft	Net CF	1.961	9.142	466.16%	-16.389 – 20.773

Source: Prepared by researchers based on the above tables

Analysis of results:

3.5.1. Operating cash flow (OCF)

A comparative analysis of operating cash flow during the period 2015–2025 shows a clear difference in the level of stability and risk between Apple and Microsoft. Apple recorded a relatively low coefficient of variation, reflecting a stable ability to generate cash from core activities and indicating low operating risk associated with the activity cycle.

However, this result should be interpreted with caution, as the Coefficient of

Variation reflects relative dispersion rather than a direct probabilistic measure of financial risk. Lower variability does not necessarily imply lower risk, as fluctuations may result from growth dynamics rather than financial fragility.

This means that Apple's OCF fluctuations were limited relative to its average, which enhances the reliability of this flow as a sustainable internal source of funding. In contrast, Microsoft exhibited a much higher coefficient of variation, indicating relatively high volatility in operating cash flows. However, this volatility does not necessarily reflect operational weakness, but is largely related to a structural shift in OCF volume, particularly after 2021, when cash flow levels rose significantly compared to previous years. Therefore, Microsoft's operational risk appears higher when analysing the period as a whole, but it declines relatively when looking at the last phase alone, which necessitates caution in interpreting CV without temporal disaggregation.

3.5.2. Net cash flow (NCF)

Net cash flow reflects a higher level of risk and volatility compared to other variables, as it is directly affected by financing decisions, distribution policies and share buybacks. In Apple's case, despite a relatively high coefficient of variation, the positive and significant average value gives CV reasonable economic significance, indicating that net cash volatility primarily reflects active management of the financing structure rather than weak cash capacity. As for Microsoft, the very high coefficient of variation of net cash flows causes the indicator to lose much of its analytical meaning, due to the arithmetic mean approaching zero and the values alternating between positive and negative. In this case, CV is not a suitable measure for comparison, but rather an indicator of the fragility of net cash and its heavy dependence on non-recurring financing flows, which increases short-term liquidity risks and limits the stability of the cash position.

3.5.3. Free cash flow (FCF)

Free cash flow is one of the most indicative measures of the real risks associated with an organisation's financing capacity, as it represents the cash available after covering capital investments. The analysis shows that Apple enjoys a higher degree of relative stability in FCF, as evidenced by a lower coefficient of variation compared to Microsoft, indicating a more consistent ability to finance growth, repay obligations, and distribute returns without experiencing sharp fluctuations. This reflects the high quality of Apple's free cash flow. In contrast, Microsoft's FCF has a higher coefficient of variation, indicating greater sensitivity to changes in capital expenditure and investment cycles, despite the overall upward trend in these flows. Thus, Microsoft's FCF risk is not so much a risk of cash weakness as it is a risk of volatility resulting from greater expansionary and investment dynamics, which calls for an assessment of these flows within a long-term strategic framework rather than a static comparison of volatility coefficients.

Ultimately, analysis of cash flows over the period 2015–2025 reveals clear

differences in stability and risk between Apple and Microsoft. Apple's operating cash flows have been characterised by relatively higher stability and lower operating risk, while Microsoft has experienced greater volatility, mainly related to a structural shift in OCF levels after 2021. Net cash flow reflects higher risk for both companies, but its significance remains more reasonable for Apple than for Microsoft, where CV loses its analytical meaning due to a near-zero average. With regard to free cash flow, the results confirm that Apple enjoys higher cash quality and better stability, compared to greater volatility at Microsoft resulting from accelerated investment and expansion dynamics.

3.6. Hypothesis testing:

To enhance the explanatory power of hypothesis testing and not just measure relative volatility through the coefficient of variation (CV), the analysis was supported by the concept of Cash-Flow at Risk (CFaR), which measures the risk of a potential decline in cash flows at a given probability level.

Regarding the first hypothesis, which assumes lower operational risk at Apple compared to Microsoft, the lower CV of Apple's operating cash flows is consistent with a lower level of CFaR, meaning that the probability of a sharp decline in operating cash flows is relatively lower, which reflects higher cash flexibility and a better ability to absorb operational shocks. For Microsoft, the high CV of operating cash flows indicates a wide range of possible distributions of cash flows and, consequently, a high CFaR, which supports the acceptance of the first hypothesis from a downside risk perspective.

Regarding the second hypothesis, related to the high risk of Microsoft's net cash flows, the very high values of the coefficient of variation, resulting from a mean close to zero and high volatility, mean in practice that the CFaR for net cash flows will be high and unstable, reflecting a greater likelihood of sudden cash declines that threaten short-term liquidity. In contrast, Apple's net cash flows, despite their volatility, have a more balanced probability distribution, which limits the value of CFaR relatively and reinforces the second hypothesis.

As for the third hypothesis, which assumes greater stability in Apple's free cash flows, the lower CV of free cash flows reflects a narrowing of the downside risk range and, consequently, a lower CFaR, indicating more sustainable financing capacity. In contrast, Microsoft's higher CV values indicate greater sensitivity to investment changes, which increases the downside risk in FCF as reflected by CFaR.

Therefore, combining CV and CFaR allows for a comprehensive risk assessment, with the former measuring relative volatility and the latter reflecting the severity of downside risk, which enhances the credibility of hypothesis testing and provides a deeper reading of cash flow risk.

4. CONCLUSION

This study aimed to examine the patterns of cash flow variability and stability in Apple and Microsoft over the period 2015–2025, with a focus on understanding the nature of relative dispersion and its implications for financial analysis. The findings reveal clear differences in the degree of variability across the two companies,

particularly in operating and free cash flows, reflecting distinct structural and strategic dynamics in liquidity generation.

The Coefficient of Variation proved to be a useful descriptive indicator for comparing relative cash flow stability across firms of different sizes. However, its interpretive power remains inherently limited, as it measures total dispersion around the mean without accounting for the direction of deviations or the probability of adverse outcomes. Therefore, it does not constitute, in itself, a direct measure of financial risk.

The analysis also highlighted the importance of distinguishing between volatility and risk. While higher variability may indicate instability, it may also reflect growth dynamics rather than financial fragility. Consequently, interpreting dispersion as a proxy for risk may lead to misleading conclusions if not supported by probabilistic analysis.

To address these limitations, the study incorporated the concept of Cash-Flow at Risk (CFaR) as a complementary measure, allowing for a more accurate assessment of downside risk. The combined use of descriptive and probabilistic indicators enhances the robustness of financial analysis and provides a more comprehensive understanding of cash flow risk.

Furthermore, the results demonstrated that Apple exhibits relatively higher stability in operating and free cash flows, whereas Microsoft shows greater variability, particularly in net cash flows due to financing-related fluctuations. However, these findings should be interpreted within their structural and temporal context, especially given the presence of significant shifts in cash flow patterns over the study period.

In conclusion, the Coefficient of Variation should be viewed as a preliminary analytical tool that provides insight into relative dispersion, but not as a standalone measure of financial risk. A comprehensive assessment of cash flow risk requires the integration of probabilistic measures, consideration of structural changes, and a clear distinction between volatility and downside risk.

4.1. Study Results

1. This suggests a higher degree of statistical stability in cash generation. This difference is statistically supported by variability comparison across sub-periods. The consistency of this pattern across sub-periods reinforces the reliability of this finding and reduces the likelihood that it is driven by random fluctuations.
2. Net cash flows showed the highest levels of variability for both companies, with Microsoft displaying extreme dispersion due to the proximity of the mean to zero and frequent sign changes. From a statistical perspective, this limits the interpretability of the coefficient of variation and indicates that net cash flows are highly sensitive to financing-related shocks rather than representing a stable indicator of underlying performance.
3. Free cash flows demonstrated comparatively lower dispersion than net cash flows and provided a more consistent statistical signal of financial capacity. The relatively narrower variability range suggests that free cash flow may serve as a

more robust proxy for assessing financing sustainability, although it remains a measure of dispersion rather than a direct indicator of probabilistic risk.

4. The Coefficient of Variation proved to be statistically useful as a standardized measure of relative dispersion, enabling comparison across firms with different scales. However, its interpretive validity is conditional upon the magnitude and sign of the mean, as well as the absence of extreme values or structural breaks within the data.
5. The analysis revealed the presence of temporal structural shifts in cash flow behavior, particularly in the later sub-period. This implies that aggregate measures of dispersion may obscure underlying dynamics, and that time-segmented analysis is necessary to ensure statistically meaningful interpretation.
6. The findings also suggest that reliance solely on accounting-based indicators may lead to an underestimation of variability and potential financial exposure. In contrast, cash flow-based measures provide a more sensitive representation of underlying fluctuations, especially when combined with complementary analytical tools.

4.2. Study Prospects

This study opens several future research avenues, most notably expanding the sample to include firms and sectors of different types, and integrating the Coefficient of Variation with other risk measures such as Cash Flow at Risk (CFaR) or downside risk, in addition to examining the impact of macroeconomic factors on cash flow volatility. Future work may also employ more advanced models to measure the relationship between cash flows and systemic risk, thereby improving analytical accuracy and supporting strategic financial decision-making.

5. Bibliography List:

1. Al-Alaf, K. K., Al-Murad, N. Y., & Yaseen, S. T. (2025, 01 01). The Role of Cash Flow Statement in Reducing Liquidity Risks in a Number of Iraqi Commercial Banks. *Journal of Information Systems Engineering and Management*, pp. 400-412.
2. looti, m. (2025, 10 27). coefficient of variation. Consulté le 2025, sur <https://arabpsychology.com/>:
<https://arabpsychology.com/trm/%D9%85%D8%B9%D8%A7%D9%85%D9%>

- 84-%D8%A7%D9%84%D8%A7%D8%AE%D8%AA%D9%84%D8%A7%D9%81-coefficient-of-variation/
3. Xia, L., Jairaj, G., Ziwen, B., & George, K. (2023, 10 1). Effect of cash flow risk on corporate failures, and the moderating role of earnings management and abnormal compensation. *International Review of Financial Analysis*, pp. 1-41.
4. Apple , A. (2025, 11 29). Apple Cash Flow Statement 2011-2025 | AAPL. Récupéré sur <https://www.macrotrends.net:https://www.macrotrends.net/stocks/charts/AAPL/apple/cash-flow-statement>
5. benseddik, m. (2021, 10 26). The role of accounting disclosure in reinforcement of the quality of financial statements - A field study. *Journal of contemporary economic research* , pp. 214-232.
6. Dodge, Y. (2008, 12 31). Coefficient of Variation. doi:https://doi.org/10.1007/978-0-387-32833-1_65
7. Gasbarro, D., Miao, H., Schwebach, R., & Zumwalt, K. (2025, 07 10). Cash holdings and risk-adjusted returns: The role of business strategy, life cycle, and managerial ability. *International Review of Financial Analysis*, pp. 1-17.
8. Gryglewicz, S., Mancini, L., Morellec , E., Schroth , E., & Valta, P. (2022, 08 1). Understanding Cash Flow Risk. *The Review of Financial Studies*, pp. 3922–3972.
9. IAS 7 , I. (2009, 04 16). Statement of Cash Flows. Consulté le 11 30, 2025, sur <https://iasplus.com:https://iasplus.com/en-gb/standards/ias/ias7>
10. Jalilibal, Z., Amiri, A., Castagliola, P., & Khoo, M. (2021, 09 7). Monitoring the coefficient of variation: A literature review. *Computers & Industrial Engineering*, pp. 1-55. doi:<https://doi.org/10.1016/j.cie.2021.107600>
11. Kuti, M. (2011, 12 31). Cash flow at risk, financial flexibility and financing constraint. *Public Finance Quarterly*, pp. 505-517.
12. Microsoft, M. (2025, 11 30). Microsoft Cash Flow Statement 2011-2025 . Récupéré sur <https://www.macrotrends.net:https://www.macrotrends.net/stocks/charts/AAPL/apple/cash-flow-statementhttps://www.macrotrends.net/stocks/charts/AAPL/apple/cash-flow-statement>
13. NIST, N. (2017, 01 24). Coefficient of variation. (U. D. Commerce., Éditeur) Consulté le 12 20, 2025, sur <https://www.itl.nist.gov/div898/software/dataplot/refman2/auxillar/coefvari.htm>
14. Wang, D. (2024, 12 06). Research on the Importance of Enterprise Cash Flow Management. *Asia Pacific Economic and Management Review*, pp. 1-7.