# Nvidia (NVDA) Stock Trend & Risk Analysis — April 2022 to April 2024

"Time-Series Case Study | Python-Based Analysis"

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📌 **Python Visualizations:**
You can explore the time-series charts and annotated trends in the final project visuals.

*Includes closing price trends, moving averages, volatility plots, and real-world event annotations.*

📌 **Python Code & Analysis Notebook:**
All scripts used for data loading, cleaning, and analysis are available in my **GitHub repository** [here](#).

*Includes full `yfinance` integration, rolling calculations, and chart generation using `matplotlib`.*

# 📄 Executive Summary

◆ **Objective:**

This project analyzes the 2-year price trend and volatility of Nvidia's stock (ticker: NVDA) to identify market patterns, risk signals, and key event impacts.
The goal is to demonstrate real-world time-series analysis using Python and draw insights that support data-driven financial decision-making.

◆ **Data Source & Period:**

- Source: Yahoo Finance via `yfinance` Python package

- Ticker: NVDA

- Time Frame: April 2022 – April 2024

- Frequency: Daily (business days)

- Metrics: Open, High, Low, Close, Volume

◆ **Tools Used:**

- **Python**: `pandas`, `yfinance`, `matplotlib`

- **Jupyter Notebook** for analysis

- **Custom visualizations**, no Tableau used in this project

◆ **Key Business Insights:**

- **Massive Price Growth**
  Nvidia's stock climbed more than **300%** over the 2-year period, with most of the growth starting after **May 2023**, triggered by record earnings and AI demand.

- **Real-World Event Impact**
  Major earnings dates (e.g., May 2023, Feb 2024) aligned directly with price surges and **volatility spikes**, confirming that financial events strongly influence market behavior.

- **Rolling Indicators Reveal Trend Strength**
  The 30-day moving average confirmed the sustained bullish trend, while volatility metrics highlighted periods of risk and market speculation.

# Section 1: Dataset Overview

◆ **Data Source & Collection**

- **Source:** Yahoo Finance via the `yfinance` Python package

- **Ticker:** `NVDA` (Nvidia Corporation)

- **Time Period:** April 1, 2022 – April 1, 2024

- **Frequency:** Daily (business days only)

- **Total Observations:** 500 rows

- **Fields Included:**

    ○ `Open`: Price at market open

    ○ `High`: Highest price during the day

    ○ `Low`: Lowest price during the day

    ○ `Close`: Price at market close

    ○ `Volume`: Number of shares traded

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◆ **Initial Data Check (Post-Cleaning)**

✅ No missing values detected
✅ Data correctly formatted with datetime index
✅ Columns cleaned (flattened from MultiIndex)

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| Price | Close | High | Low | Open | Volume |
|---|---|---|---|---|---|
| **Ticker** | NVDA | NVDA | NVDA | NVDA | NVDA |
| **Date** | | | | | |
| **2022-04-01** | 26.669741 | 27.452501 | 26.225445 | 27.331692 | 517235000 |
| **2022-04-04** | 27.316715 | 27.514402 | 26.570897 | 26.685715 | 397120000 |
| **2022-04-05** | 25.889973 | 27.275777 | 25.779148 | 27.210879 | 436615000 |
| **2022-04-06** | 24.368387 | 25.259974 | 23.965027 | 24.894554 | 703833000 |
| **2022-04-07** | 24.169704 | 24.682891 | 23.440860 | 24.402336 | 557992000 |

◆ **Data Preprocessing Steps**

- Used `yfinance.download()` to collect data

- Dropped multi-index column level to simplify

- Verified shape, column names, and nulls

- Created new columns for:

  ○ `MA_30` → 30-day moving average

  ○ `Volatility_30` → 30-day rolling standard deviation

# Price Trend & Moving Average

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◆ **Objective:**

Visualize the long-term trend of Nvidia's stock using its daily closing price and a 30-day moving average to smooth out short-term fluctuations.

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◆ **Methodology:**

- **Closing Price** was plotted using raw daily values from the `Close` column.

- **30-Day Moving Average (MA_30)** was calculated using Pandas `.rolling(window=30).mean()` on the closing price.

- Both were plotted on the same chart for comparison and trend clarity.

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Nvidia (NVDA) Closing Price & 30-Day MA (2022–2024)
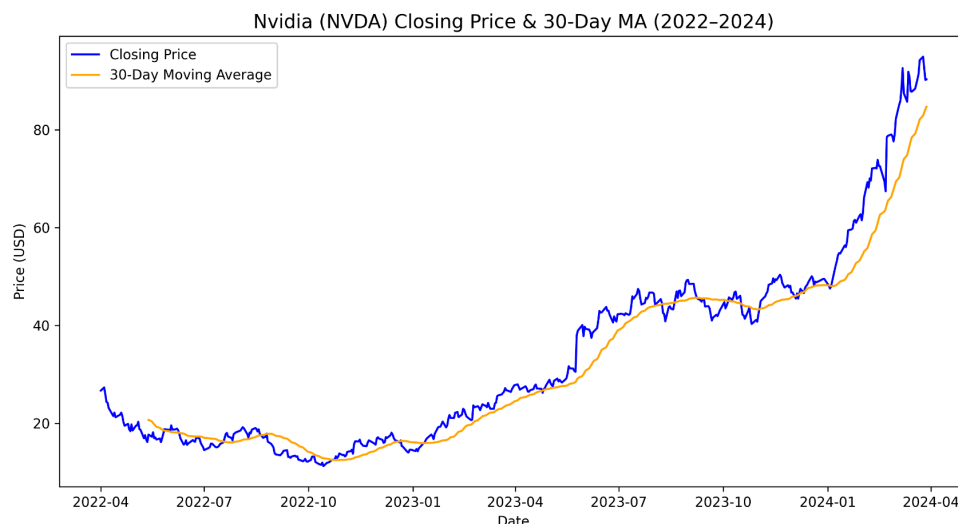
## 🔍 Interpretation:

- From mid-2022 to early 2023, Nvidia's price was relatively flat or declining.

- In **mid-2023**, the price began a strong uptrend, with the closing price consistently **above** the 30-day MA, a classic bullish signal.

- The distance between the price and MA widened dramatically in 2024, indicating **strong momentum**, but also suggesting a higher risk of overextension.

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## 💡 Business Insight:

The 30-day moving average reveals a **sustained bullish phase** starting mid-2023. This supports a long-term growth outlook, particularly for trend-following investors and funds.

# Volatility Analysis

### ◆ Objective:

Measure and visualize the **risk level** in Nvidia's stock by calculating the **30-day rolling volatility**, using standard deviation of daily closing prices.

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### ◆ Methodology:

- Used `.rolling(window=30).std()` to calculate the **30-day rolling standard deviation** of the `Close` price.

- Plotted the result as a standalone line chart to observe changes in volatility across time.



Nvidia (NVDA) 30-Day Rolling Volatility (2022–2024)
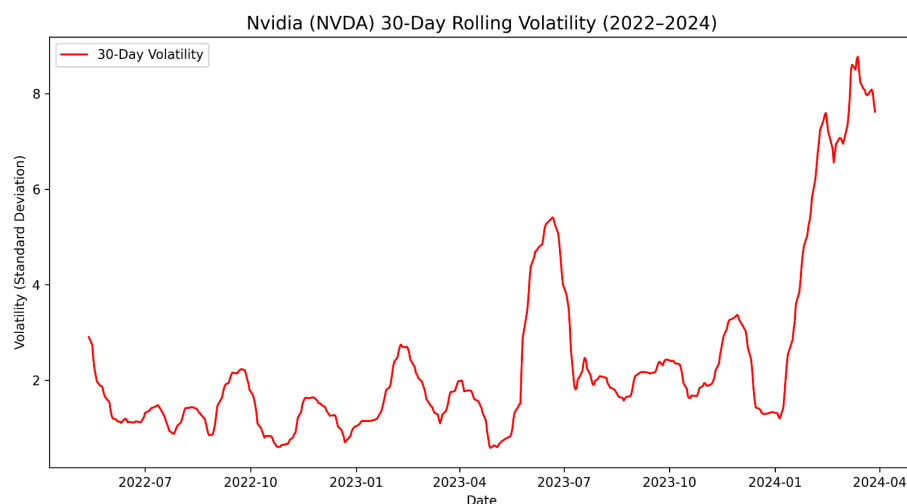
## 🔍 Interpretation:

- **Low volatility** throughout 2022 and early 2023 suggests a period of market calm or consolidation.

- **Major spike** in mid-2023 coincides with Nvidia's record-breaking Q1 earnings tied to the **AI chip boom**.

- **Volatility surged again** in early 2024 around another earnings announcement, reflecting either investor excitement or uncertainty.

- The chart highlights that **risk increases with momentum**, especially in fast-moving, growth-focused stocks.

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## 💡 Business Insight:

Volatility is not always bad,  but it's a warning flag. Spikes in Nvidia's volatility match exactly with its biggest stock price moves, especially after key earnings. This insight can help investors time entries/exits or adjust their position sizing for risk."

# Annotated Price Chart with Key Events

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### ◆ Objective:

Overlay real-world events, specifically Nvidia's **earnings announcements**, onto the price chart to understand how news impacts stock behavior.

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### ◆ Methodology:

- Used `matplotlib` to add **vertical lines** and **custom labels** on the closing price chart.

- Annotated 3 major earnings events that significantly impacted price and volatility.

- Adjusted label placement, spacing, and rotation for maximum readability and presentation quality.

Nvidia (NVDA) Stock with Key Earnings Events (2022–2024)
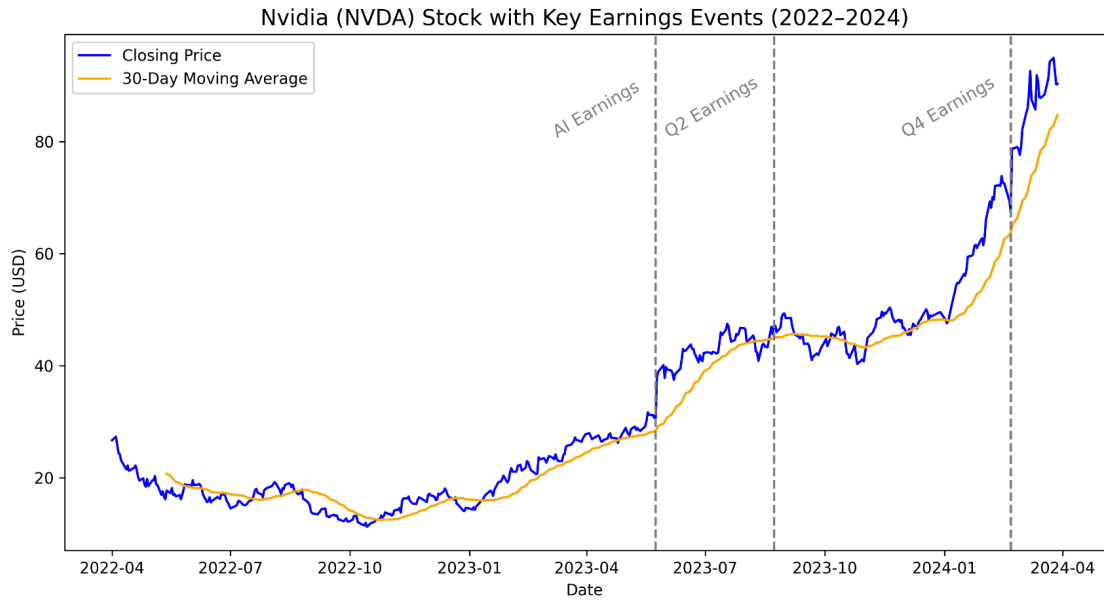
## 🔍 Annotated Events:

| 📅 Date | Event | Impact |
|---|---|---|
| **May 24, 2023** | Q1 Earnings (AI Boom Begins) | 💥 Stock jumped ~24% overnight — start of the rally |
| **Aug 23, 2023** | Q2 Earnings | 🔄 Sustained strong performance, stock stabilized at new highs |
| **Feb 21, 2024** | Q4 Earnings | 🚀 Record earnings again, volatility surged, new breakout |

## 💡 Business Insight:

These events represent real **decision points**. For analysts and investors, earnings dates are windows of **high opportunity and high risk**. This annotated chart shows how directly Nvidia's market behavior aligns with fundamental business performance.

# Conclusion & Business Takeaways

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◆ **Summary of Findings:**

- Nvidia's stock has shown **exceptional upward momentum**, especially since mid-2023.

- Key earnings reports acted as **catalysts** for both price spikes and volatility surges.

- The 30-day moving average clearly captured the **trend direction**, while rolling volatility identified **risk zones**.

- Real-world annotations helped contextualize the market's behavior beyond just numbers, linking it to investor sentiment and corporate performance.

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◆ **Business Takeaways:**

- 📈 **Momentum Investing**
  Long-term price trends combined with moving averages can help identify entry points for momentum-based strategies.

- ⚠️ **Volatility = Risk**
  Spikes in volatility are common after major events and should inform **risk management**, especially for institutional investors.

- 📅 **Earnings Matter**
  Financial events like earnings are **not noise**, they're some of the **most predictive factors** in stock movement.

- 🧠 **Data-Driven Analysis Matters**
  With basic Python tools, it's possible to extract actionable financial insights using **public data**, making this kind of analysis accessible and valuable to any organization.