# **Part 1: Economic Indicators**

**Data wrangling process**

Firstly, all datasets were checked for null and duplicate values. There were none. Next, the date column was converted from object to datetime datatype and share price and GDP columns from object to float datatype. Lastly, new columns daily return, 5-day moving avg., and rolling volatility were calculated for VTI and VXX.

a)A graph of a stock market

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Figure 1: Comparison of United States’s GDP to share price of VTI ETF and VXX ETN a) from 2024 to 2025 and b) from 2015 to 2025.

**How have GDP, VXX, and VTI changed during the last year or so? How have these values changed with respect to each other? Are they moving together, or counter to each other?**

From Fig 1a, GDP and VTI steadily increased from Jan to Oct 2024, except in Aug when VTI experienced a significant dip in price. In contrast, VXX remained stable from Jan to Jul 2024, followed by a spike in Aug 2024. This is because the rapid decline in VTI, an ETF which tracks the entire US stock market, led to an increase in US market volatility, and a spike in VXX, a short-term futures index which tracks market volatility.

**How have GDP and Consumer Sentiment changed during the pandemic? What was the general trend before 2020 and how has it changed from 2020 onwards?**

From Fig 1b, between 2015 to 2020, VTI was steadily increasing in price. In Mar 2020, because of the pandemic, both GDP and VTI experienced a huge dip and VXX saw a huge spike. From Mar 2020 to Jan 2022, due to covid vaccine sales, remote work, and online shopping, both the pharma and tech sectors experienced record-breaking growth, leading to increase in GDP and VTI. From 2022 to 2023, with recovery from covid, economic growth slowed down and both GDP and VTI decreased. From 2023 onwards, positive sentiment driven by easing inflation, positive earnings and job reports led to an increase in GDP and VTI.

**What are the limitations of using this data in understanding the health of the national economy?**

The granularity of GDP is not as high as the VTI and VXX data which leads to loss of important insights when establishing the relationship between them. For both VTI and VXX, the data has not been adjusted to account for stock splits, which took place on Aug 2016, Aug 2017, Apr 2021, Mar 2023, and Jul 2024. This leads to a discontinuous line plot and difficulty in deriving actionable insights from the price trend.

# **Part 2: Cryptocurrencies**

**Data wrangling process**

Firstly, all 5 cryptocurrencies were checked for null and duplicate values. There were none. Next, the date column was converted from object to datetime and the share price columns from object to float datatype. Lastly, new columns daily return, 5-day moving avg., and rolling volatility were calculated for all datasets.

a)A graph of different types of cryptocurrency

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AI-generated content may be incorrect.

Figure 2: a) Comparison of the top 5 cryptocurrencies by market capitalization and b) comparison of Bitcoin’s share price to that of VTI ETF and VXX ETN.

**What has happened in the cryptocurrency market in the last few years?**

From Fig 2a, the crypto market has been mostly stable between Jul to Nov 2024. In Dec 2024, Bitcoin reached an all-time high, crossing $100k. This was spurred on by Donald Trump’s presidential election win as he is expected to embrace deregulatory policies, generating bullish sentiment for the entire crypto market. In early 2025, Bitcoin and the total crypto market experienced a decline but, by May 2025, recovered and reached new highs, driven by institutional adoption such as the setting up of Bitcoin reserves.

**How has the price of Bitcoin moved in regards to VTI, the overall measure of stock prices? In regards to VXX?**

From Fig 2b, VTI experienced a slow but steady increase between Aug to Dec 2024. VXX remained mostly stable from Aug 2024 to Mar 2025, indicating low market volatility. In contrast, Bitcoin saw a spike in Dec 2024 to an all-time high. Overall, Bitcoin’s volatility was not well-reflected by VXX. However, Bitcoin bears broad similarities to VTI’s price trend. When VTI saw a rapid decline between Mar to Apr 2025, so did Bitcoin. Similarly, when VTI prices rebounded from Apr 2025 onwards, Bitcoin prices also went up.

**What are the limitations of using this data to try to understand the cryptocurrency market?**

These are the top cryptocurrencies by market capitalization, excluding stablecoins, that were available for download from Alpha Vantage and not representative of the entire market. To better track the performance of the market, market indexes for cryptocurrencies such as CMC, NCI, or BGCI should be used for comparison. Only 1 year worth of data is available and not reflective of the history of the crypto market.