Market Reliability Measures

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IDAS & IAS event on modelling
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Motivation

Tail risk events in financial markets are associated with liquidity events.

In the wake of market selloffs, there are no buyers when large amount of investors are rushed to sell and exit the markets.

Exogenous factors such as a large institution collapse, a virus outbreak or uncertain economic climate could lead to a feedback loop of selling in very illiquid markets.

Fat tails, excessive volatility and increase in liquidity risk (Illiquidity).

Use of conventional statistical models for risk management is proven flawed.

Not accounting for non-normality particularly fat tails.

Develop robust and dynamic liquidity risk measures for market reliability.

Turbulent Markets: from Covid, War to Taming Inflation...

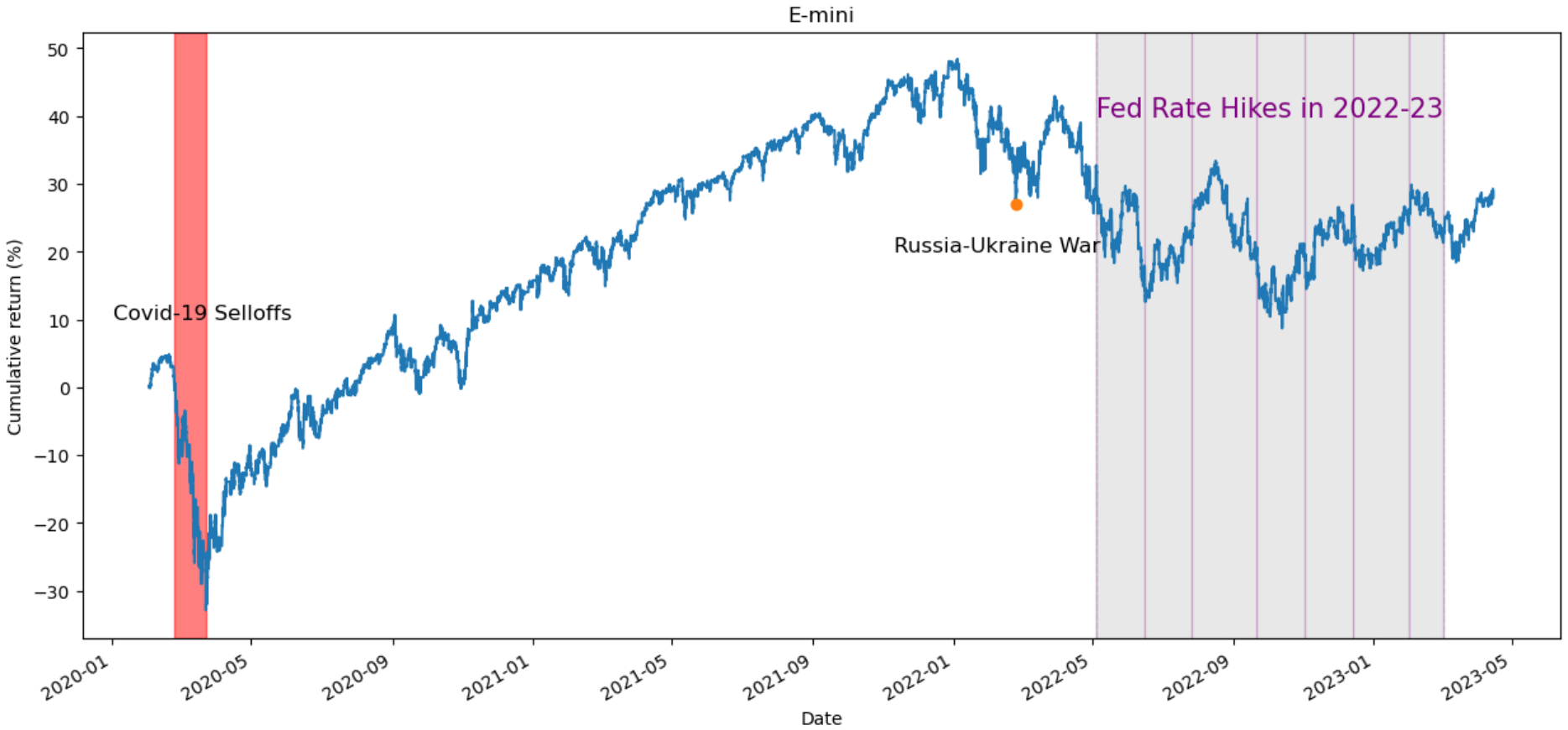

Figure 1 – Cumulative Price Returns for the S&P500 Emini futures

Stylised Facts

Risk management, based on distributions of historical returns and simulations, assume normality of metrics [such as returns in Value-at-Risk (VaR) models].

A static approach where the level of loss is based on a level of confidence, typically 95% or 99%.

The static approach fails if the variables are non-normal and fat-tailed.

Liquidity events occur more frequently. Ignoring them underestimates the magnitude of fat tails events.

The static approach tells us nothing about the risk and the loss beyond the confidence interval.

There is a strong evidence from the data that risk should be adjusted "dynamically" to changing market and liquidity conditions.

Non-linear liquidity metrics (Power Law), including our liquidity measure.

Modelling Technique

Extreme Value Theory (EVT), a statistical tool dealing with extreme events, has been used increasingly in financial risk management (VaR Models), among other major fields such as physics, engineering, earth sciences, ect..

To deal with a *"life that always has a fat tail"*.

EVT does not assume normality; it intends to model tails of distribution beyond the level of confidence.

Most importantly, EVT provides information on the size of losses in Black Swans event environments (fat tails).

Test whether EVT can be a tool for monitoring liquidity crashes - extreme price events that are mainly driven by liquidity shortages in financial markets.

Large trading losses, and risk of financial contagion.

Extreme Value Theory: "Extreme Illiquidity Index"

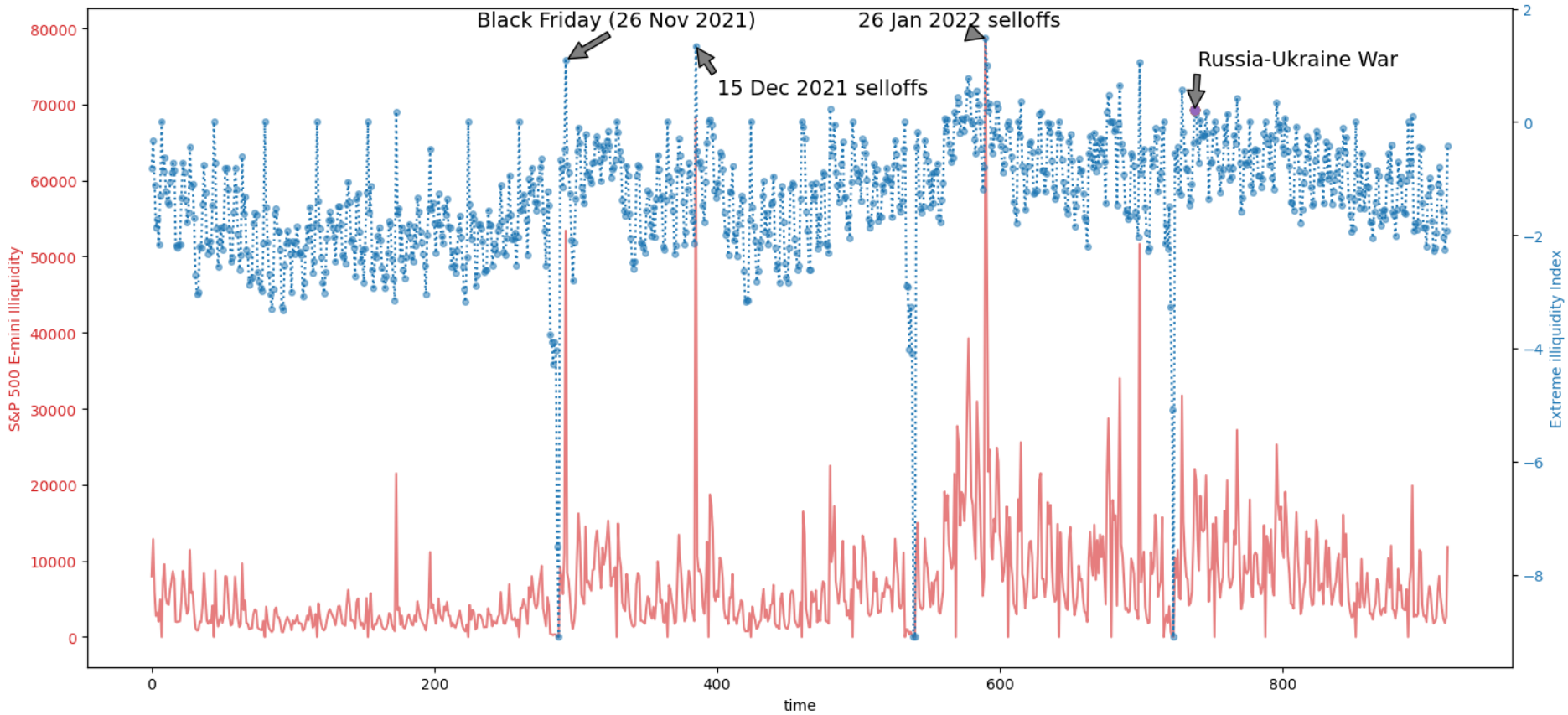

Figure 2 – Extreme Illiquidity Measure

Sample Period: Hourly data from October 2021 till End of March 2022.
Our Illiquidity Measure: Quote Volatility from tick-by-tick data (supplied by Refinitiv).

Do Limitations matter?

EVT assumes that the series of observations are independent and identically distributed.

However, tail liquidity events tend to cluster, and this creates dependence among the events.