

MILLISECOND REACTIONS TO MARKET SHOCKS

From Order Flow to Cross-Asset Opportunity

April 2025

LMAX | Group

LMAX Group is a global financial technology company and the leading independent operator of multiple institutional execution venues for FX and digital assets trading. With offices in 9 countries and a global client base, the Group builds and runs its own high performance, ultra-low latency exchange infrastructure, which includes matching engines in London, New York, Tokyo and Singapore.

The LMAX Group portfolio includes LMAX Exchange, LMAX Global and LMAX Digital.

LMAX | Exchange

LMAX Exchange operates global institutional FX exchanges, an FCA regulated MTF and MAS regulated RMO, offering Spot FX, FX NDFs, metals, commodities and indices. Our central limit order book model delivers efficient market structure and transparent, precise, consistent execution to all market participants, including funds, banks, proprietary trading firms, brokerages, asset managers and buy-side institutions.

LMAX | Digital

LMAX Digital is a leading institutional crypto currency exchange regulated by the Gibraltar Financial Services Commission (GFSC) as a DLT provider for execution and custody services.

Leveraging LMAX Group proven, robust technology and liquidity relationships, LMAX Digital delivers a market-leading solution for physical trading and custodial services for the most liquid crypto currencies – such as BTC (Bitcoin), ETH (Ethereum), LTC (Litecoin), BCH (Bitcoin Cash), XRP (XRP), SOL (Solana), LINK (Chainlink), PYTH (Pyth Network), UNI (Uniswap), AAVE (Aave), DOGE (Dogecoin) and RLUSD (Ripple USD).



Macro Hive is a leading independent provider of global macro research and strategy with a worldwide user base spans 160 countries and over 1,000 institutions. Our mission is to give investors a trusted platform to discover the best investment opportunities in an accessible and concise format. To do this, we combine best-in-class human and artificial intelligence, leveraging all the latest technologies to develop innovative, data-driven solutions to complex financial problems. Our state-of-the-art models and indicators use predictive analytics, deep learning, and natural language processing in search of alpha signals across asset classes. Our team of seasoned experts features ex-heads from global organisations such as JP Morgan, Nomura, Deutsche Bank, the IMF, and the NY Fed.

From the Authors



Our previous report in November 2024 highlighted the pace at which FX markets—the most liquid market in the world—price-in key information immediately following US macroeconomic data releases. Our latest findings show BTC’s correlation to FX markets, the depth of markets even around political events like Trump’s social media posts. The results emphasise the need for traders to have access to high-frequency data and liquidity, both of which are showcased using LMAX Group data in the report.

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Clients are increasingly relying on quality data to drive trading decisions across asset classes. We have leveraged on MacroHive’s ability to analyse the markets to jointly release this report to offer unique and predictive insights on the markets using millisecond LMAX Group FX and cryptocurrency order book data, building on our earlier report released in November 2024.

Arun Sundaram

Head of Market Data, LMAX Group

Summary

In this report, we focus on five market moving events: the announcement of Donald Trump as US President (2024-11-06), the pausing of Mexico/Canada tariffs (2025-02-03), two Fed rate decisions (2024-12-18, 2024-03-20) and a fake news headline on a rumoured 90-day tariff pause (2025-04-07).

These events resulted in significant movements in EUR/USD and BTC/USD. We focus on one false headline related to tariff uncertainty which caused high volatility across asset classes.

We demonstrate that movements in mid prices immediately following events are notable, and access to high frequency data can allow traders to capitalise on trends faster.

The two pairs exhibit high correlations in price movements around events, though not necessarily in the same direction. While BTC/USD shows higher volatility than EUR/USD, there is evidence of similar levels of reaction by markets, also indicating good liquidity and market efficiency for cryptocurrencies.

The data around Fed meetings also illustrates the comparable efficiency between crypto markets and foreign exchange markets.

Deep levels of the order book indicate market dynamics for BTC/USD. Examining one Fed rate decision shows significant movements in trading volumes shortly after the event, at the second to fourth best ask prices. The high amount of available liquidity and quick response to the event implies an efficient market.

LMAX Digital millisecond data demonstrates the speed and efficiency of both cryptocurrency and FX markets. BTC/USD prices immediately after events show fast market reactions.

Lastly, we analyse the impact of Trump's social media posts have the power to move cryptocurrency markets. Examining his announcement of the Canada/Mexico tariff pause, we find that the market reacts just seconds after the post.

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Event Analysis and Price Action

In November 2024, a joint report by Macro Hive and LMAX Exchange found substantial high frequency price action in EUR/USD around key US macroeconomic events. These moves happen considerably quicker than any other market, highlighting the depth of currency markets.

In this report, we want to understand the relationship between FX and crypto prices around key events to identify whether cryptocurrency markets process news as quickly as the largest and most liquid market in the world. To do so, we begin by examining price moves in EUR/USD and BTC/USD around five key events.

Crypto Markets Rival FX Markets in Efficiency

Chart 1A shows the movement in mid-price up to 60 minutes after each event time. Evidently, a jump occurs very soon after each event, which would not be as easily seen without high frequency data.

In the first 60 seconds, displayed in Chart 1B, we observe notable fluctuations in mid-price for both BTC/USD and EUR/USD. On average, the first 2 seconds after each event captured 18.12% of the price action over the next 10 minutes, over both EUR/USD and BTC/USD. For BTC/USD, the average was 11.87%, while for EUR/USD, the average was 24.37%. This is calculated based on the ratio of the magnitude of mid-price movement from 2 seconds after the event to that of 10 minutes after.

After the December 2024 Fed rate decision, both pairs fell initially, and continued to fall in the minute afterwards. An early sign of a drop could be a signal of similar movements in the following time periods, following the momentum. If both pairs tend to move similarly on certain events, any deviations could revert to follow the trend.

Chart 1A: Mid-price movements after key events (2 hr)

EUR/USD, BTC/USD

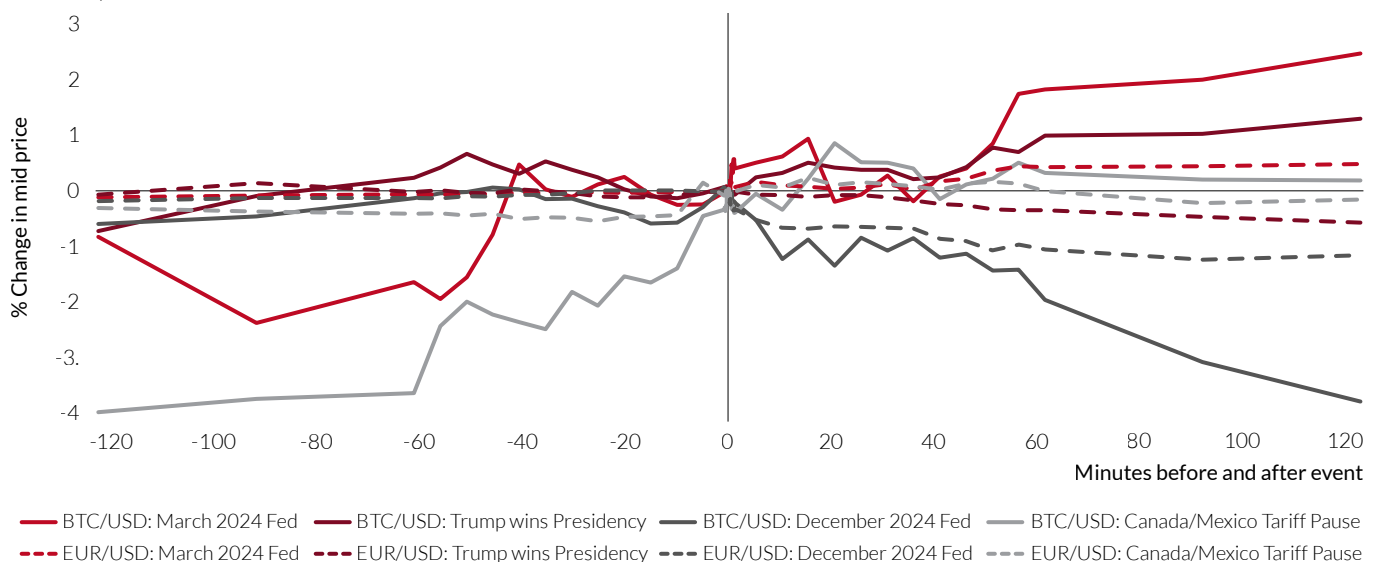
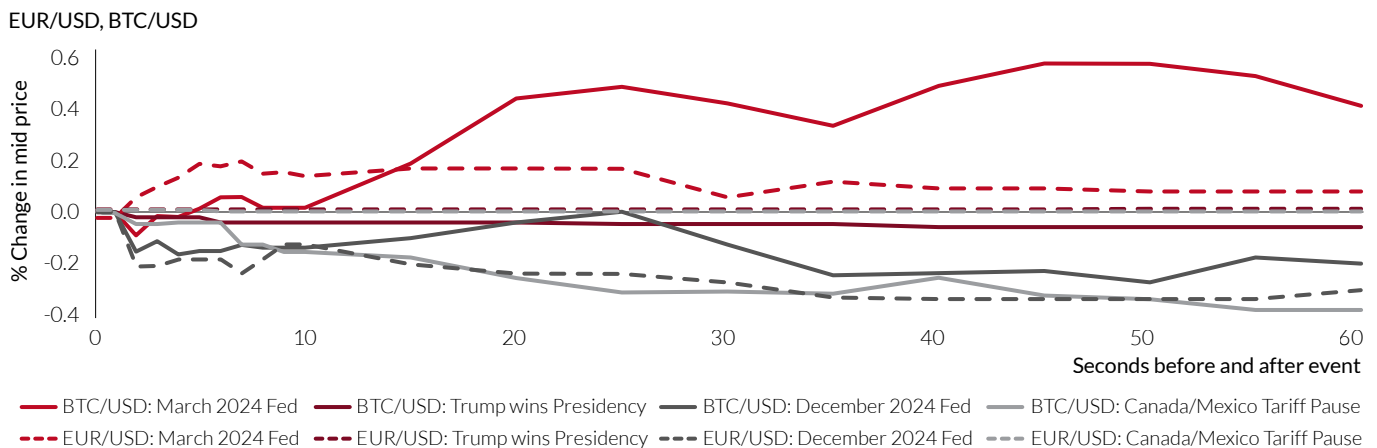


Chart 1B: Mid-price movements after key events (60 sec)

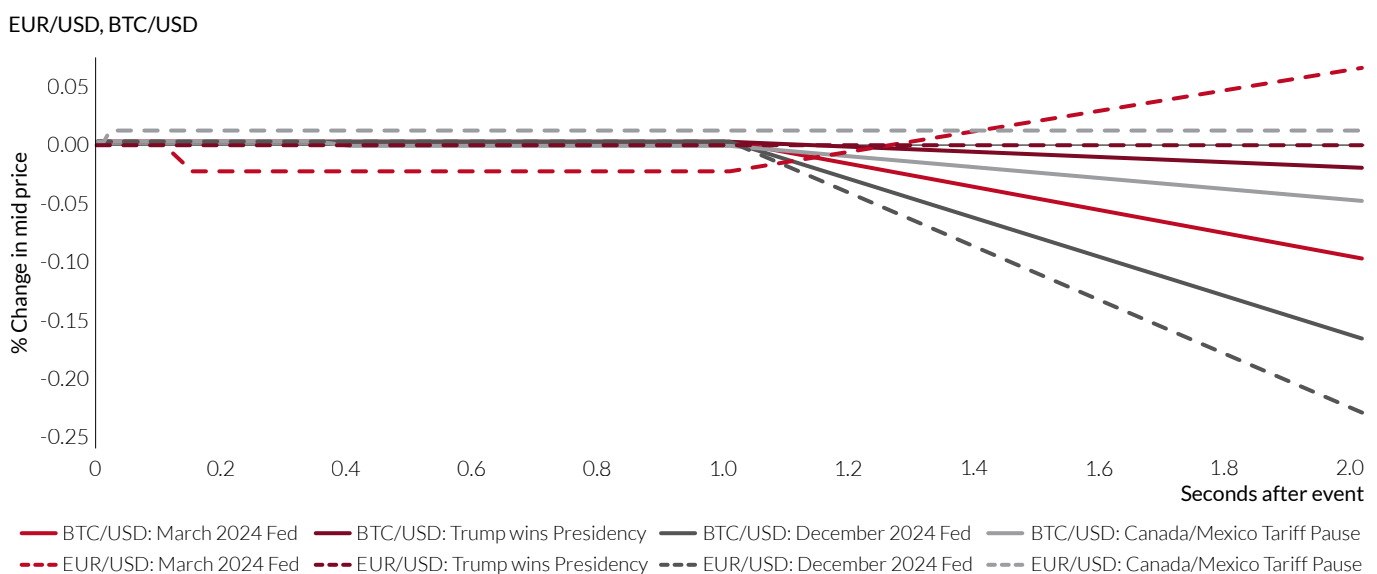


The data demonstrates that crypto markets react as quickly as FX markets to both Fed rate decisions and political events. The events show a similar pattern of price action between the pairs. For example, after the December Fed meeting, both responded with a sharp drop at first, before slowly continuing the trend over time, as seen in Chart 1A. This suggests that crypto markets responded to the same degree as the highly liquid foreign exchange markets, indicating a comparable level of liquidity and efficiency.

Additionally, at Trump's tariff pause, BTC/USD shows significantly higher volatility, indicating a noisier market. In Chart 2, we examine the 2 seconds after each event. Even in this short time, we see simultaneous price movements in BTC/USD and EUR/USD. Although the direction and magnitude vary, the timing of the reaction is comparable. This shows that both markets react to these events at a similar pace.

Overall, we see that crypto markets respond as quickly to events as FX markets, and there is evidence of similar patterns of price action across both.

Chart 2: Market reaction immediately following events (2 sec)



Fed Events: The Market Responds Rapidly to the Fed

LMAX Exchange and LMAX Digital data illustrates how quickly markets respond to interest rate decisions by the Fed. Chart 1A gives the full picture of the 4-hour interval around each event, while Chart 1B zooms into the first 60 seconds afterward.

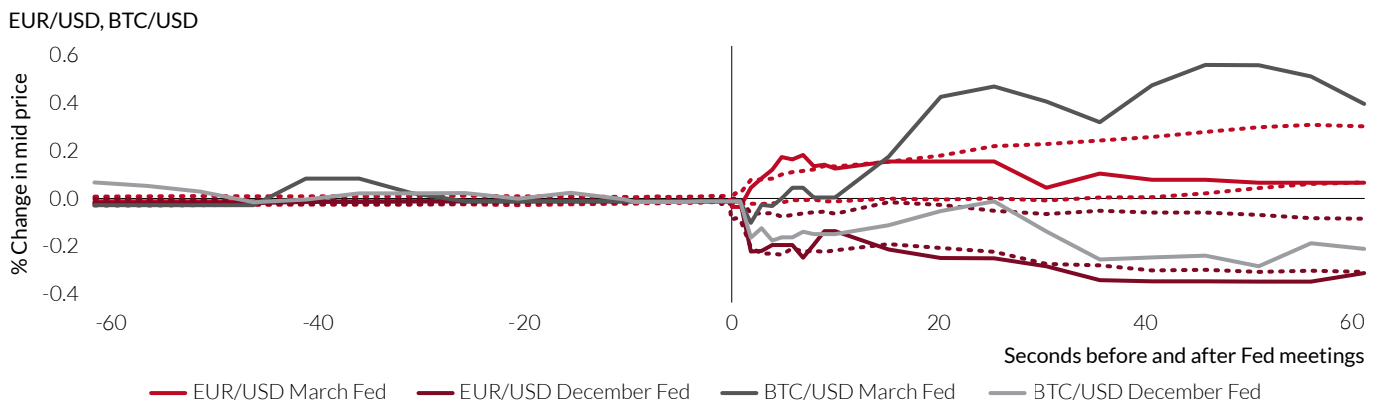
The Fed held rates at the March 2024 meeting, but both BTC/USD and EUR/USD moved up in response, indicating a dovish tone relative to expectations. As a result of the Fed rate decision, by the end of the day, BTC/USD had moved up 9.66%. Additionally, EUR/USD showed a steep increase just seconds after the event, as seen in Chart 1B. Surprisingly, BTC/USD shows a slight drop, before increasing significantly afterwards. This indicates a similarly efficient market, despite the two pairs not moving in the same direction initially.

At the December 2024 meeting, the Fed cut 25bps, but with a hawkish tone. Both pairs dropped in the first few seconds following the announcement. BTC/USD fell 0.157%, while EUR/USD declined 0.216% in the first 2 seconds. BTC/USD showed a brief recovery to its level pre-event but moved lower again afterwards. As expected, EUR/USD showed little price action prior to the event, before decreasing over 1% in the 60 minutes afterwards. Chart 1B shows that even in the first minute, EUR/USD had already moved over 0.3% lower. The magnitude of movement of EUR/USD in the first 60 seconds already represents 26.6% of its movement by 2 hours after the event. Clearly, the highly liquid FX market reacted quickly to the Fed's decision.

Overlaying the Monte Carlo simulations of EUR/USD price moves following Fed events from the November report, we see that the March and December Fed meetings caused larger than usual moves, with the price on or exceeding the confidence intervals (Chart 3). This indicates that they are more important than typical Fed meetings. We also include the BTC/USD moves onto the chart, which shows the more volatile nature of cryptocurrencies in their reactions to Fed events versus traditional FX.

The key takeaway is that the cryptocurrency markets move as quickly as traditional FX markets, often to a greater degree. They are more volatile and price action is driven by different events, though they also coincide occasionally, such as on Fed rate decisions.

Chart 3: Responses to Fed rate decisions with Monte Carlo simulations



US Politics are a Key Driver of Price Action

Donald Trump has demonstrated his ability to create volatility in markets. In this report, we also analyse the impact of his actions, with an emphasis on the cryptocurrency markets, rather than EUR/USD. Although Trump and US politics matter for BTC/USD, they appear to not have much effect on the FX markets. Chart 1B demonstrates how much more BTC/USD moves on these events in comparison.

Trump's announcement as president (somewhat anticipated by the market) and pause of his tariffs on Canada and Mexico (a surprise) both caused large moves in BTC/USD. Taking a broad view around both events in Chart 1A, we see that BTC/USD began to climb well ahead of the announcement of the tariff pause, with a slightly extended rise afterwards, before stabilising just above the level at the moment of the event. By the end of the day on both events, BTC/USD moved 7-9% higher.

On both occasions, however, EUR/USD did not respond to the same degree as BTC/USD. Given that Trump's presidential victory was anticipated by the market and not a fully exogenous event, this may explain the reduced price action. EUR/USD also exhibited very gradual price action after Trump's win. It is evident that although both markets responded to political events, crypto markets moved to a higher degree.

Price Moves Correlate Between BTC/USD and EUR/USD

Not only does BTC/USD move as quickly as EUR/USD, but correlation is also remarkably strong between the two pairs. Across all events, taking the percentage change in mid-price from the time of the event, we obtain correlations of magnitude greater than 0.7. We observe highly related price movements, but not always in the same direction.

The average correlation between the two pairs over the first minute following each event are as follows:

- March Fed: 0.737
- December Fed: 0.888
- Trump announced as President: -0.780
- Canada/Mexico tariff pause: 0.850

The December Fed most clearly illustrates the close relationship between the two (Charts 4A and 4B). The broader view shows that the prices move generally in tandem, though BTC/USD presents greater volatility. In the 2 minutes around the event, we see a much closer alignment of price moves, which also depicts greater volatility in BTC/USD prices.

Charts 5 and 6 show the movements around political events. As expected, BTC/USD and EUR/USD move in opposite ways around Trump's announcement as president (Chart 6). At the time, markets were anticipating that his policies would benefit cryptocurrencies, while his potential tariffs would weaken the Euro against the US Dollar.

Lastly, the tariff pause caused both pairs to rise in value. Again, we see an elevated level of volatility in BTC/USD. Both markets reacted with an increased risk appetite and an improved outlook for the Bitcoin and the Euro. A similar recovery would have been expected for US equity markets.

Chart 4A and 4B: Correlated price movements on the December Fed

Chart 4A

EUR/USD, BTC/USD

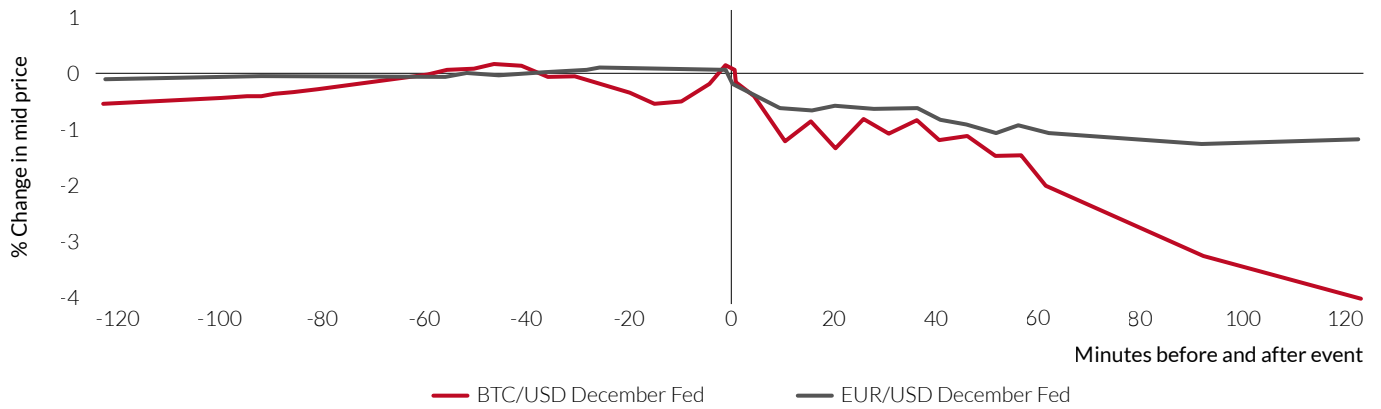
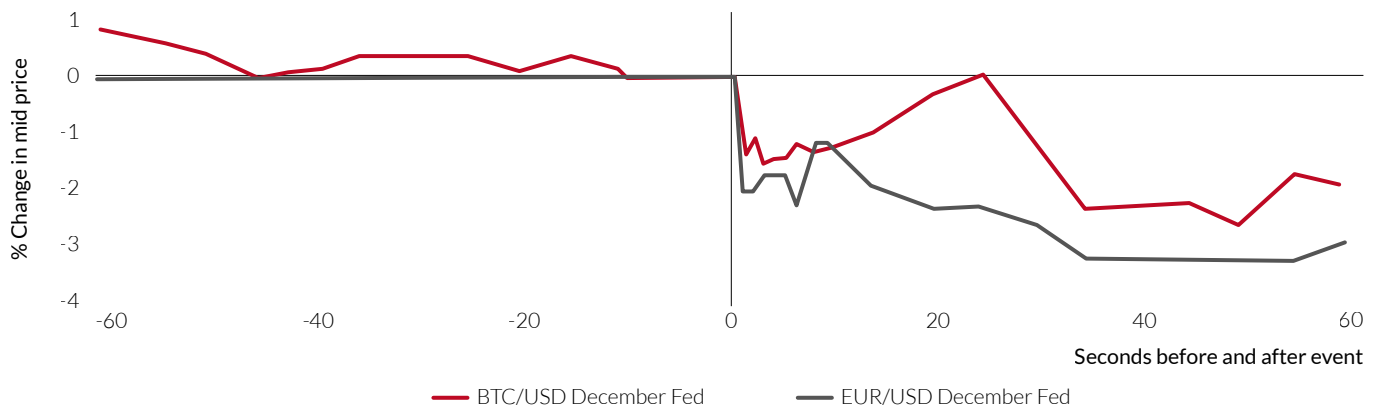


Chart 4B

EUR/USD, BTC/USD



Charts 5 and 6: Price movements on political events

Chart 5

EUR/USD, BTC/USD

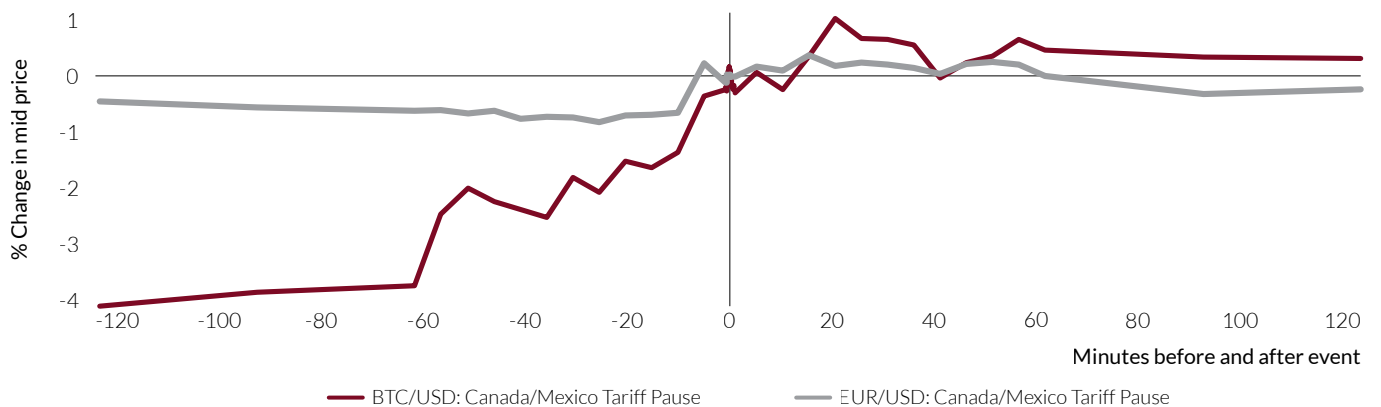
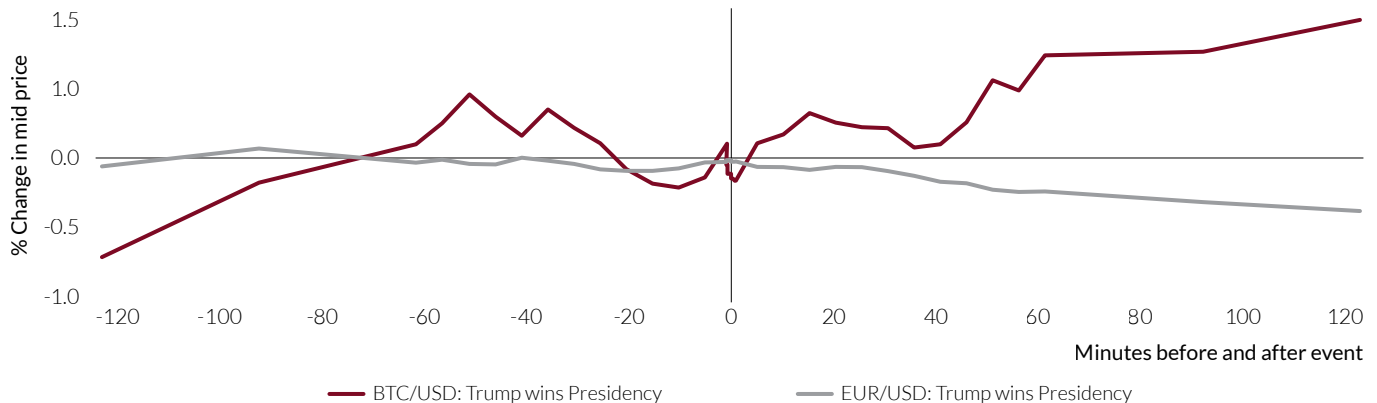


Chart 6

EUR/USD, BTC/USD



BTC/USD Millisecond Level Volumes Give Insight into Future Trades

LMAX Digital data provides deep levels of the order book to millisecond precision for BTC/USD bid and ask prices. In both Chart 7 and 8, BTC/USD prices prior to the Fed's December rate decision show typical patterns. However, ask prices show some volatility in just the first 100 milliseconds. This is not observed in the bid prices.

At the 1 second post-event, both bid and ask prices not only drop rapidly, but the gap between the prices at different levels also narrows significantly. This may be due to traders looking for the fastest possible execution of their order as market activity surges. The decline extends for approximately half a second before levelling off, as the activity fades back to a more stable level.

The March Fed decision shows a very different pattern in prices. In Chart 9 and 10, we see a less clear pattern of price action on both sides of the order book. In particular, all price levels appear to move similarly, and the magnitude of the move is relatively small compared to that of the December meeting.

Without the additional levels of the order book, these trends would not have been visible. With five levels of depth, the data paints a clear picture of the market's sentiment around key events.

Charts 7 and 8: Ask and Bid prices by depth, December Fed

Chart 7

BTC/USD

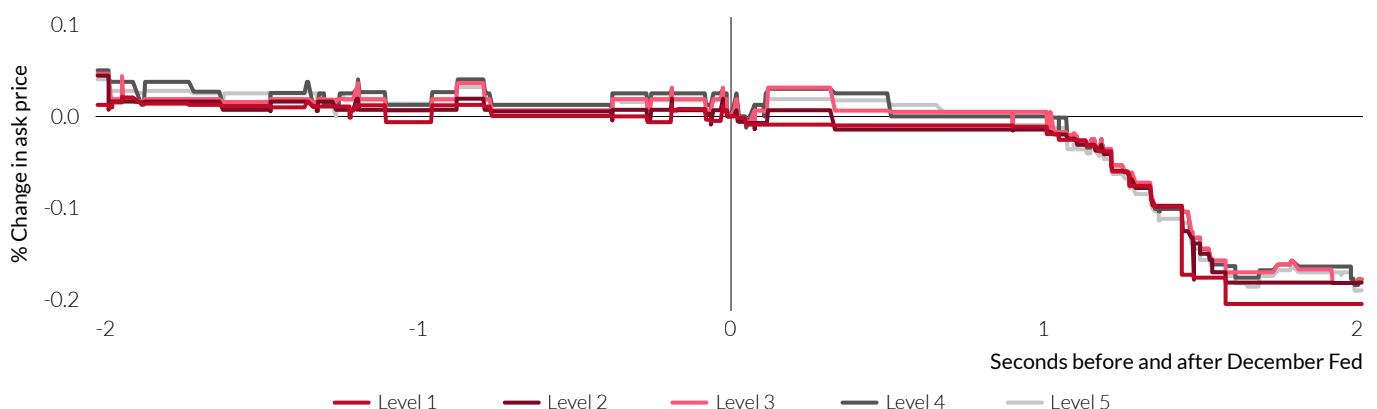
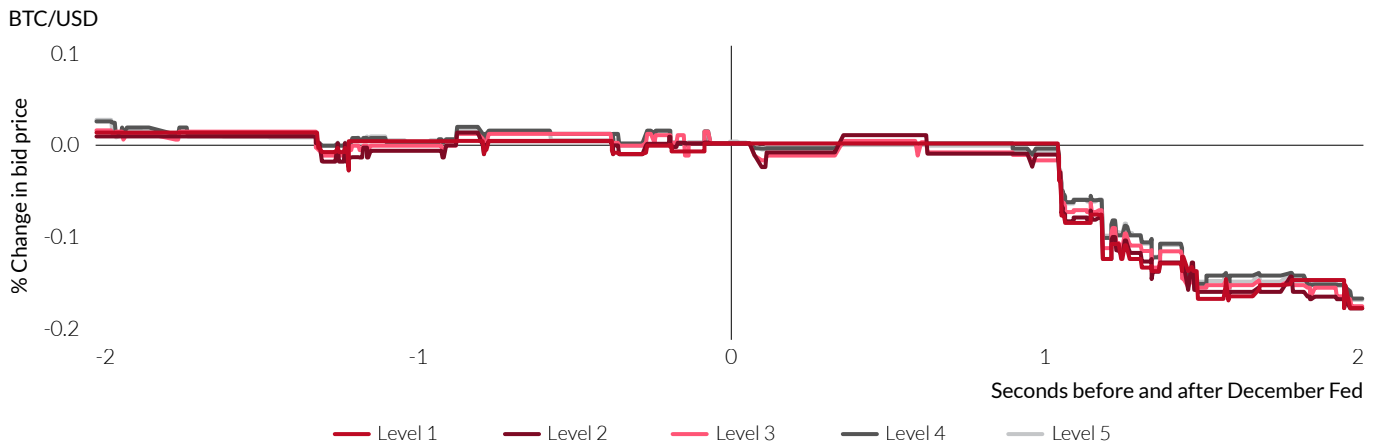


Chart 8



Charts 9 and 10: Ask and Bid prices by depth, March Fed

Chart 9

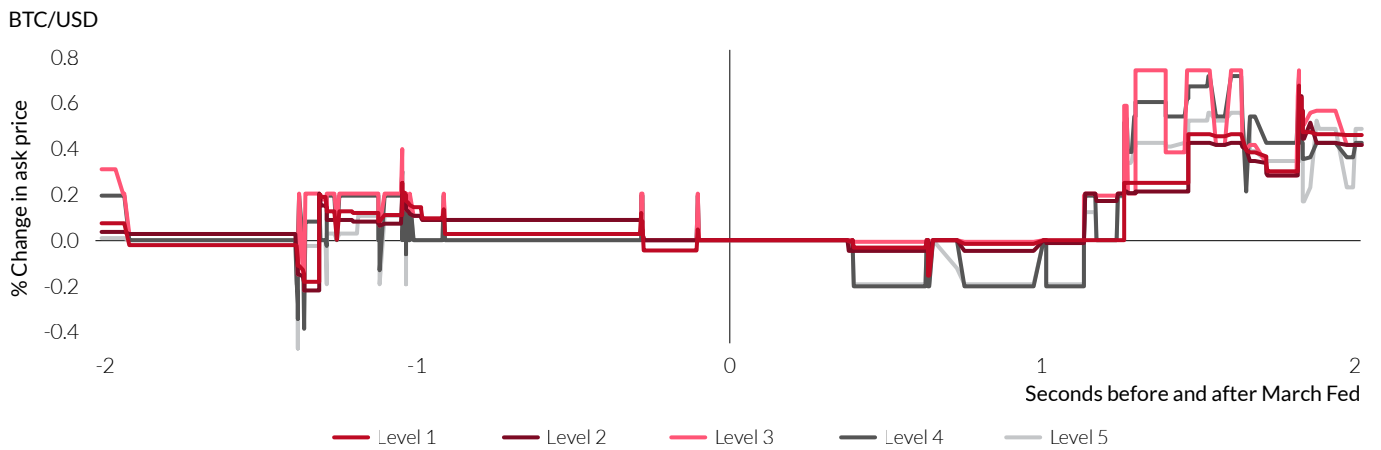
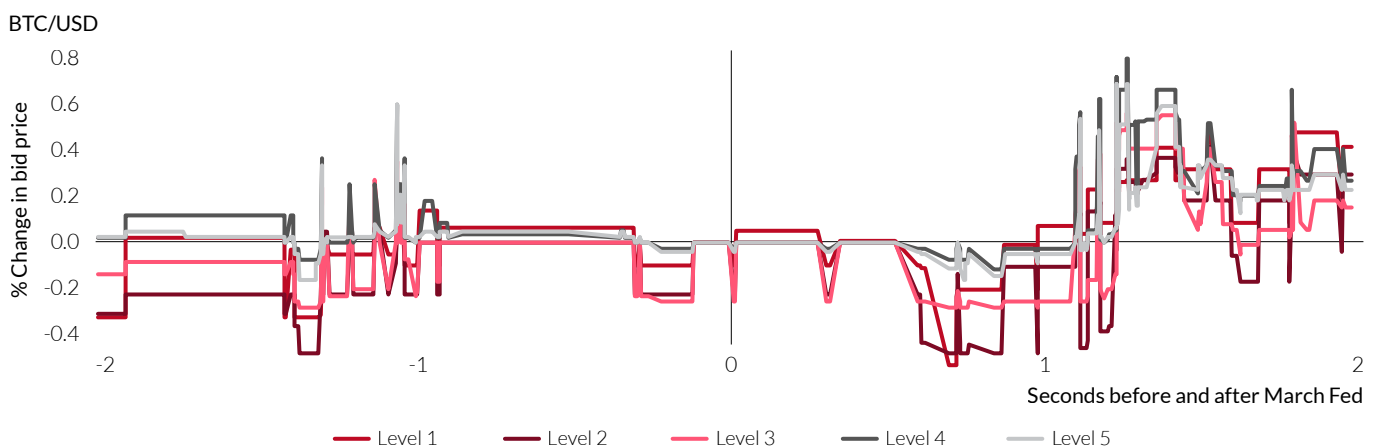


Chart 10



What LMAX Digital order book data tells us

Next, we analyse the high-frequency order book data from LMAX Digital and show how its granularity and depth allow actionable insights into cryptocurrency markets.

Digging Deeper: BTC/USD Shows Liquidity at Deeper Levels

For the BTC/USD order book depth analysis, we consider five levels on both sides. We focus on the December Fed meeting, as this clearly illustrates the dynamics of the deeper order book levels.

Firstly, we inspect the interval from 1 minute before the event to 1 minute after. Recalling that the event resulted in a sharp initial decline in BTC/USD, we would expect to see an increase in the ask volume as traders try to liquidate their position, or as market makers provide greater liquidity in response to the elevated trading activity. Indeed, in Chart 11, we see a steeper increase in the cumulative ask volume just seconds after the event.

Additionally, the gap widens between the levels. In fact, the liquidity available at level 2 surpasses that of level 1 briefly, around 35 seconds after the event, before fading to around the same level at 60 seconds. Lastly, at around 45 seconds post-event, we see a flattening of the volume curve across all levels, possibly indicating a change in momentum as traders react to falling prices.

Chart 12 shows the bid volumes. Clearly, the pattern is more linear, though the top of book shows a jump in volume which fades around 30 seconds prior to the event. Overall, we see less reaction at deeper levels of the bid side, with relatively narrow gaps between levels 2 and 5. The top of book shows a steady increase in volume and also demonstrates a brief flattening at the same time as the ask volumes, around 45 seconds after the event. The reduced activity on the bid side may indicate less liquidity provided by market makers, or reduced interest in buying BTC/USD during this period. The two charts clearly show the market sentiment.

On the other hand, the March Fed displays a much steeper ramp up in ask volume (Chart 13) at the top of book, suggesting a high demand for ask liquidity as investors aim to sell the currency pair. This is slightly reflected in the level 2 volumes, but not at deeper levels. Chart 14 clearly shows a steeper bid volume curve after the Fed's decision, and liquidity increased at all levels of the order book. However, note that the top of book price has the lowest volume. Most of the volume is in the deeper levels of the book.

The extra liquidity available at deeper levels of the book reveals hidden activity in the market which otherwise would not have been visible. These levels indicate that investors are placing orders without the intent of immediate execution.

Charts 11 and 12: Cumulative Ask and Bid volume curves by depth, December Fed (1 min)

Chart 11

BTC/USD

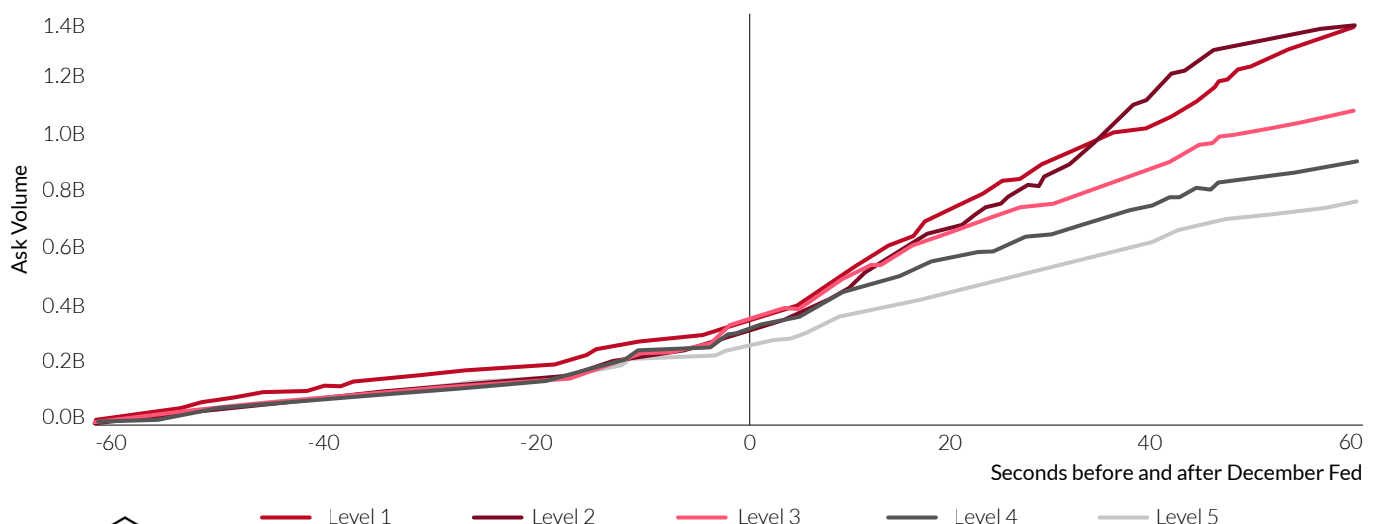
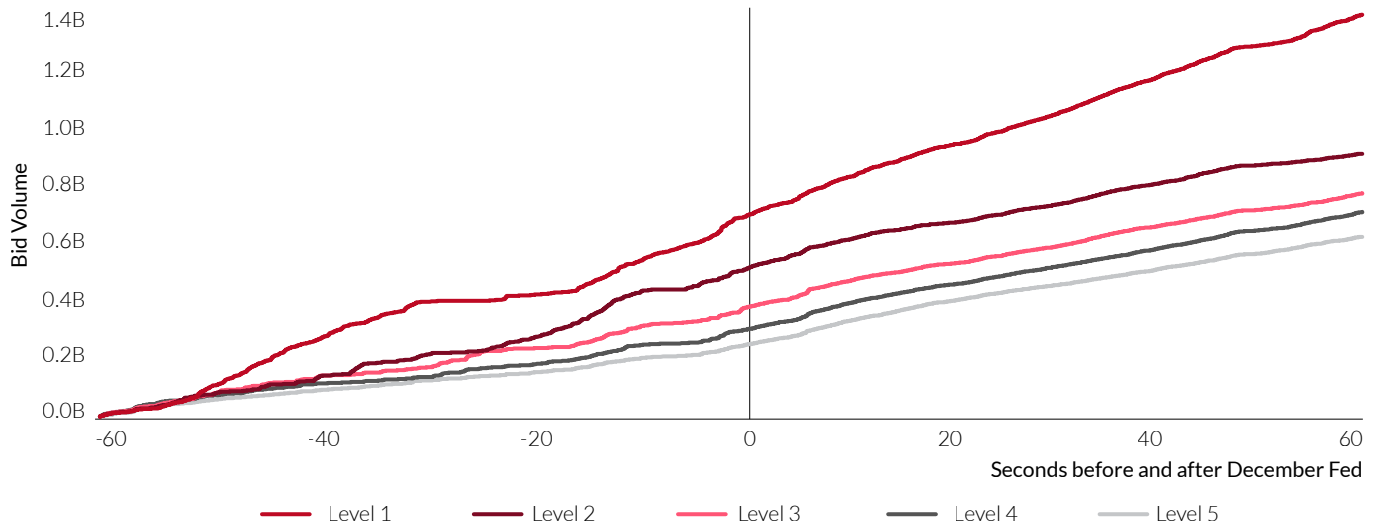


Chart 12

BTC/USD



Charts 13 and 14: Cumulative Ask and Bid volume curves by depth, March Fed (1 min)

Chart 13

BTC/USD

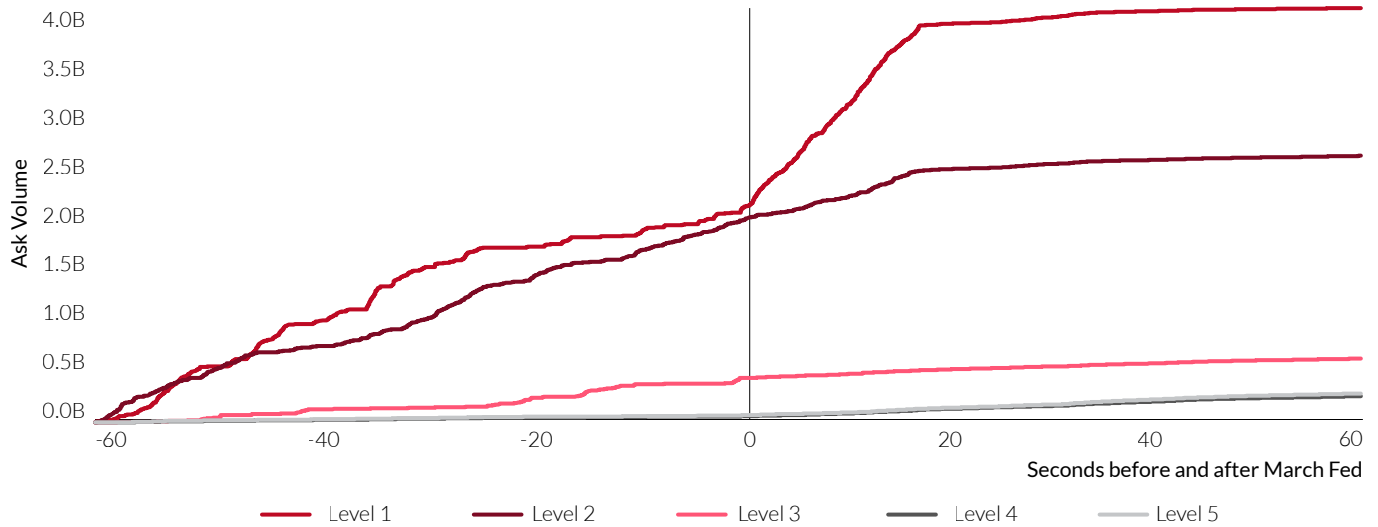
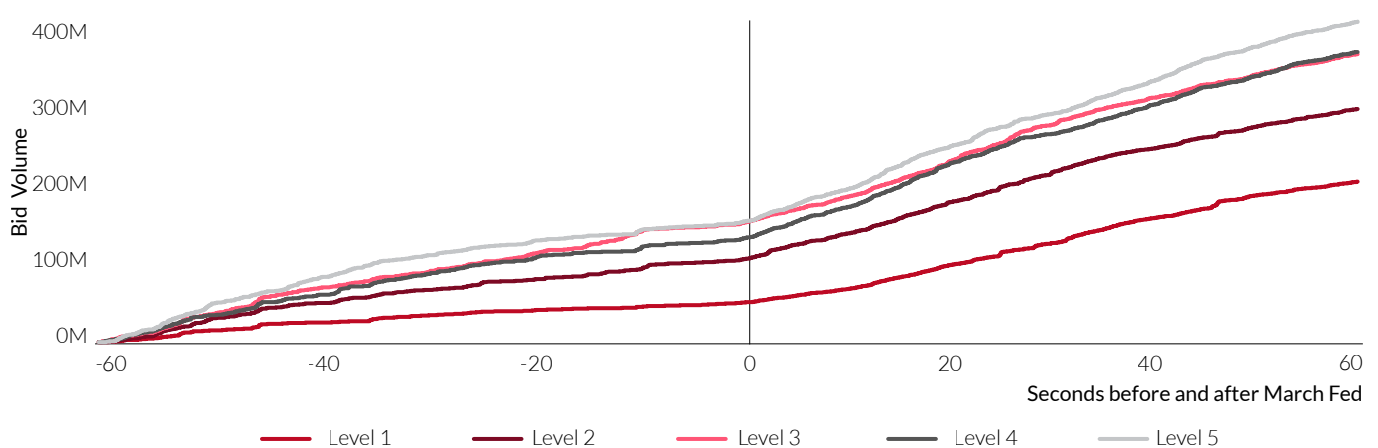


Chart 14

BTC/USD



BTC/USD Millisecond Volumes Give Insight into Future Trades

LMAX Digital order book data provides deep levels of the order book to sub-millisecond precision. On examining the 4 seconds around each event time, the ask volume curves interestingly show greater liquidity at deeper levels (Chart 15 and 16). In fact, level 3 shows the most liquidity, with level 1 having the second lowest liquidity, only above level 5. This may be due to institutional investors placing orders deeper in the book to manage execution impact.

A noticeable jump in volume can be seen around the 1 second mark in Chart 15. This spike in activity is likely the result of the first large trades in response to the Fed's rate decision, though we can also see a small volume increase immediately following the event. Compared to the ask volumes, the bid volumes in Chart 16 show a more typical pattern. The volume at the top of book far exceeds that of any of the deeper levels. The curve also shows a pronounced increase in volume in the first 200 milliseconds after the event. This is possibly the result of high-frequency traders capitalising on the sudden price drop.

Charts 17 and 18 depict high-frequency volumes at the March Fed rate decision. Firstly, there was an imbalance between bid and ask volumes, with significantly more liquidity available for the ask side. We also observe that volumes only begin to ramp up around 1 second after the release, which is due to factor such as latency in the information reaching traders, and the time taken for trades to be made and executed. There is an "elbow" pattern in the volume curves in both sides, which shows a sharp increase in traded volume as the market processes the Fed's decision. Again, we notice that the top of book does not necessarily have the highest volumes. The volumes for the second best asking price overtake that of the best price at around 1.5 seconds after the event, while there is much more volume at deep levels of the bid side. The best bid price actually has the lowest trading volume.

High-frequency data allows clients to react as quickly as possible to events like these, and to take full advantage of the initial price moves. With the large increase in volumes, it is clear that this event had a noticeable impact on BTC/USD.

LMAX Digital data shows not only the speed at which markets respond to key events but also offers insight into potential market moves in the short time after events. By capturing the high-frequency trades made immediately after the event time, investors can anticipate larger trades from slower-moving investors soon after.

Charts 15 and 16: Cumulative Ask and Bid volume curves by depth, December Fed (2 sec)

Chart 15

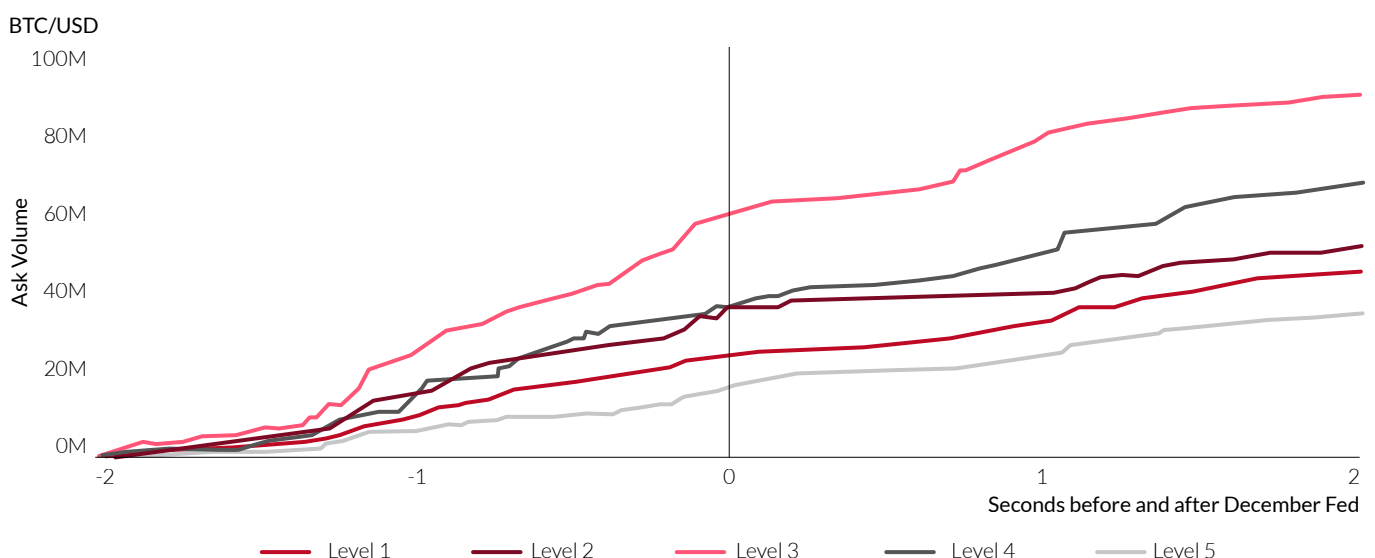
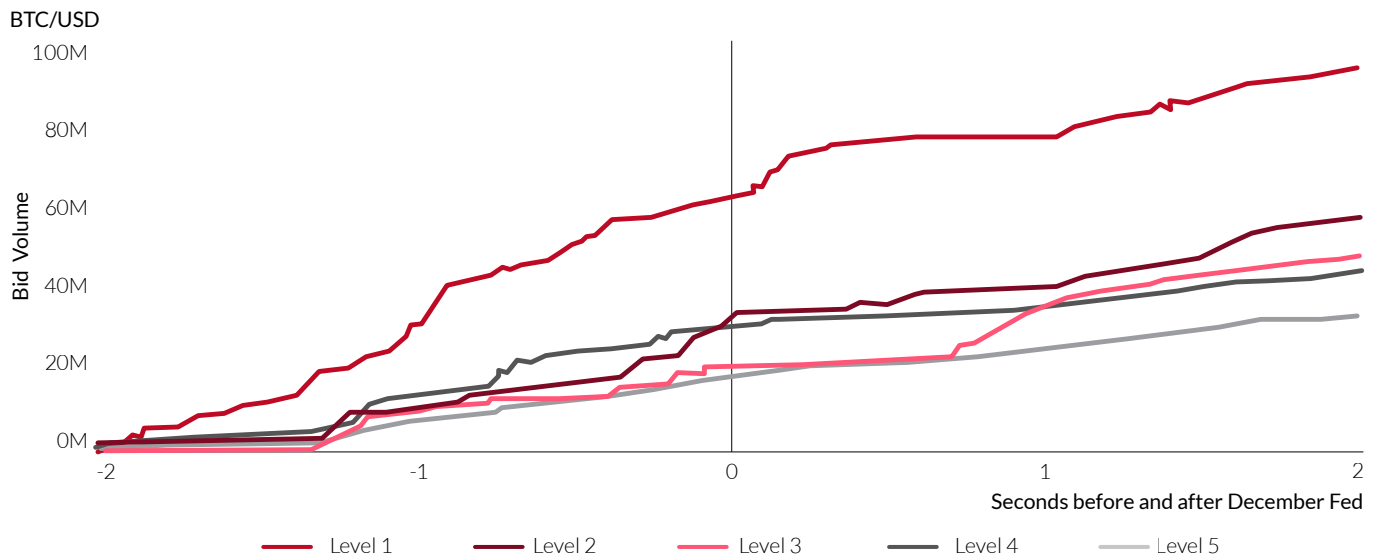


Chart 16



Charts 17 and 18: Cumulative Ask and Bid volume curves by depth, March Fed (2 sec)

Chart 17

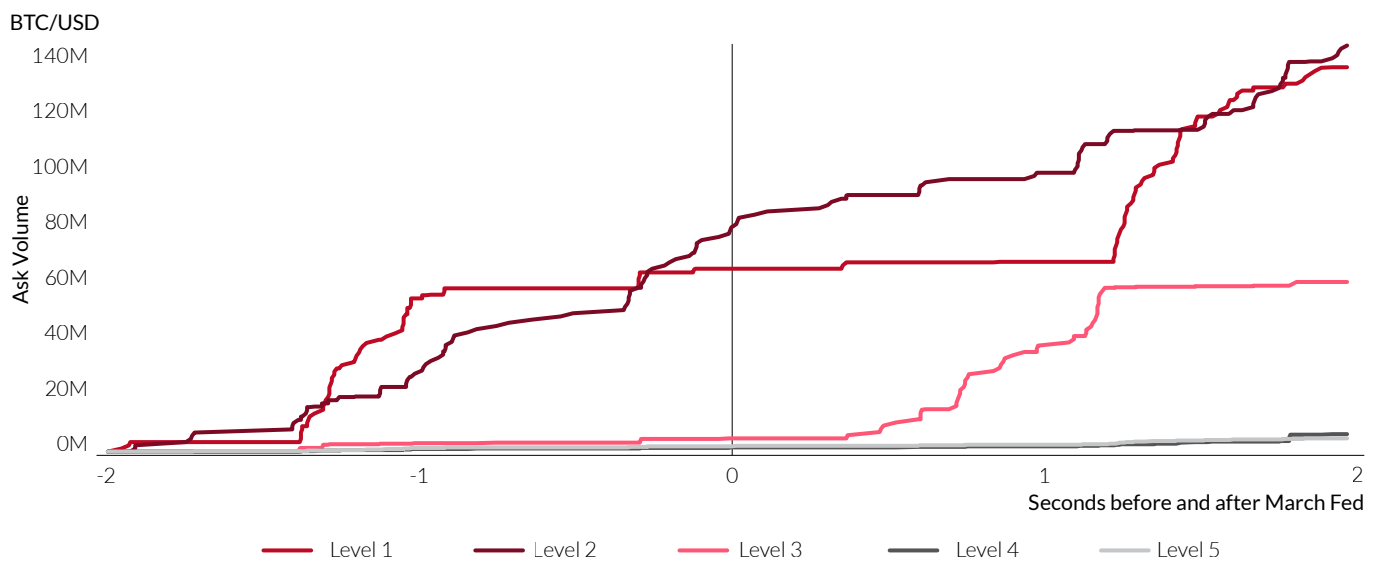
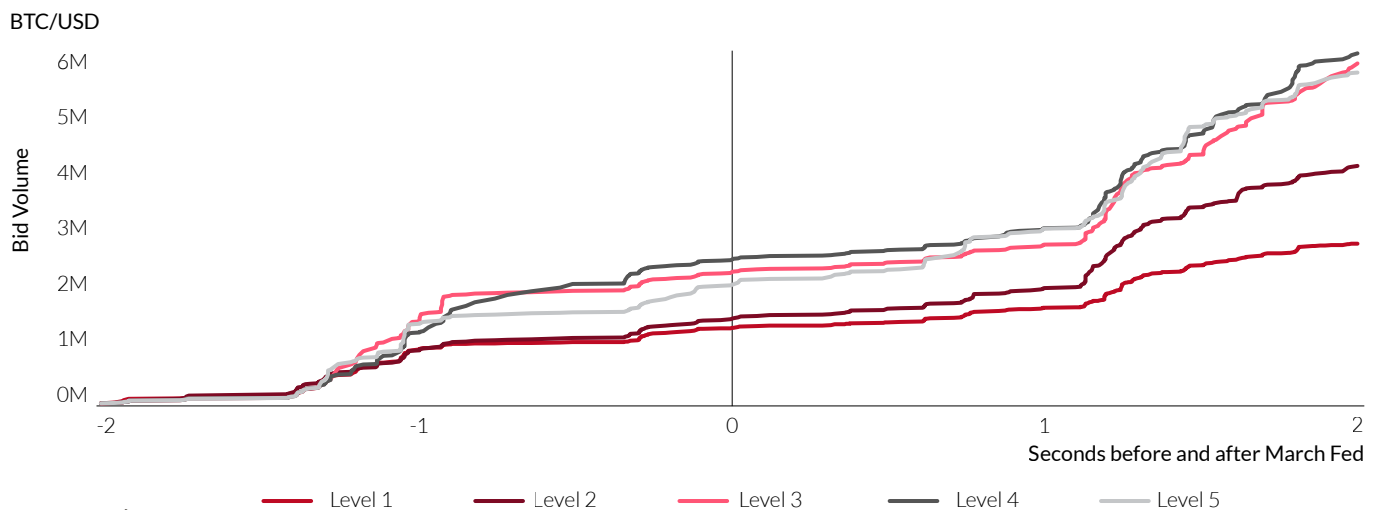


Chart 18



Trump Tweets & Tariffs

Uncertainty around Donald Trump's tariff policies and his posts on social media have demonstrated their power to move markets. In this section, we explore the extent to which Trump tweets and tariff news can impact the market.

Misleading News Leads to Significant Market Volatility

On 7th April 2025, a comment made by Kevin Hassett, Director of the National Economic Council, was misinterpreted as an indicator that President Donald Trump was considering a 90-day tariff pause on all countries except China. The first of the tweets which mentioned this headline was made around 14:11 GMT, with several other reports following, including from CNBC and Reuters. This resulted in a brief surge across equity markets, before a confirmation from the White House that the report was false led to a sharp decline.

The cryptocurrency markets also reacted significantly to the news. Chart 19 shows that, less than 1 minute afterwards, BTC/USD gained 1%. Indeed, on observing the ask volume in Chart 20, there is a noticeable increase at the top of book prior to the 1-minute mark as demand for selling ramped up. Afterwards, the slight dip then led to a rise in bid volumes, seen in Chart 21, between the first and second minute after the event. This could be due to traders increasing their buying on the slight price decline. Additionally, bid volumes are greater at deeper levels of the order book, with top of book having the lowest trading volume.

Overall, BTC/USD was impacted by the fake tariff pause headline, and it is evident that market participants reacted quickly, causing price action and increasing liquidity. High frequency LMAX Digital data prevents clients from falling behind on market volatility.

Chart 19: BTC/USD mid-price, fake news headline

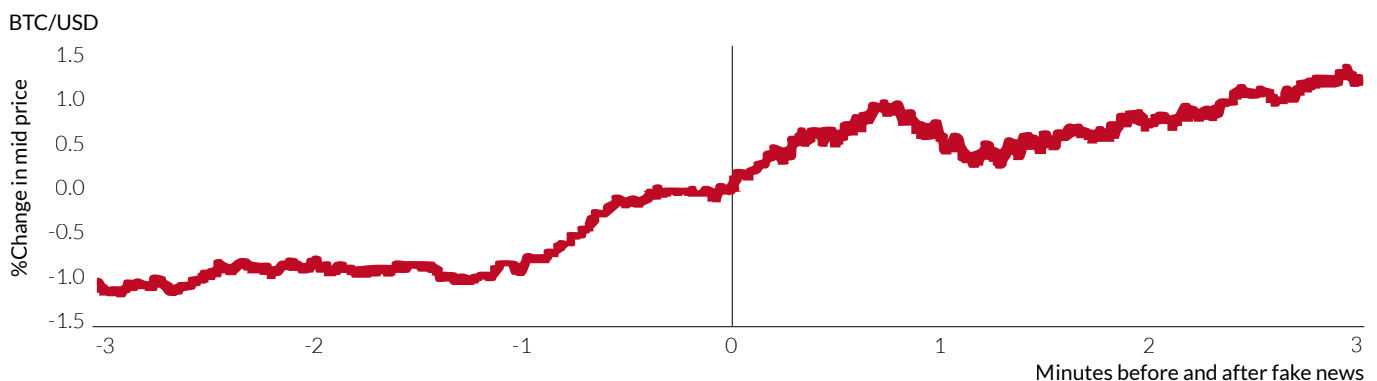


Chart 20 and 21: BTC/USD Ask and Bid volumes, fake news headline

Chart 20

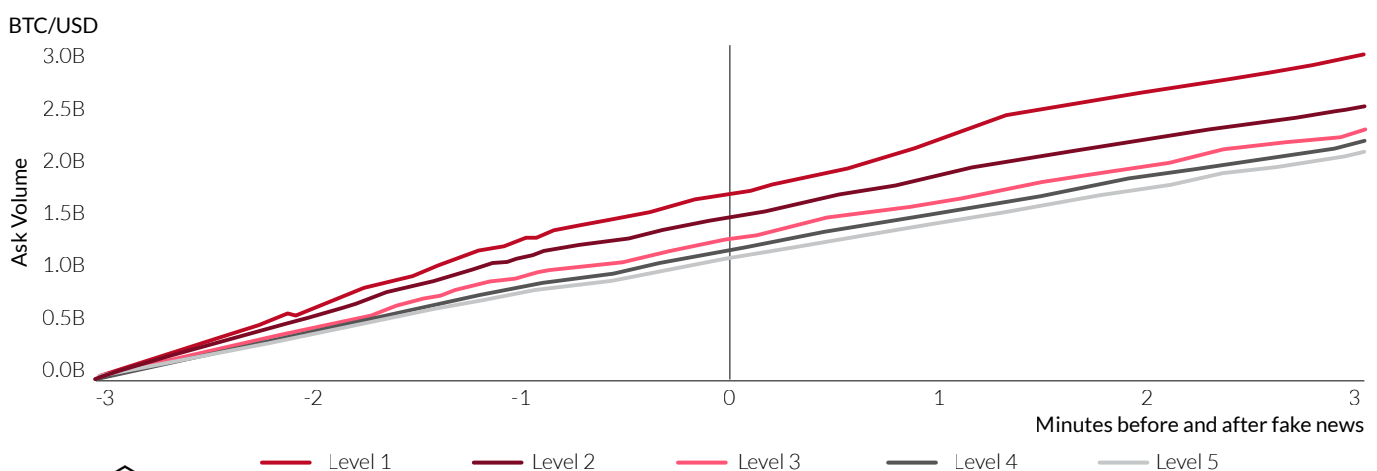
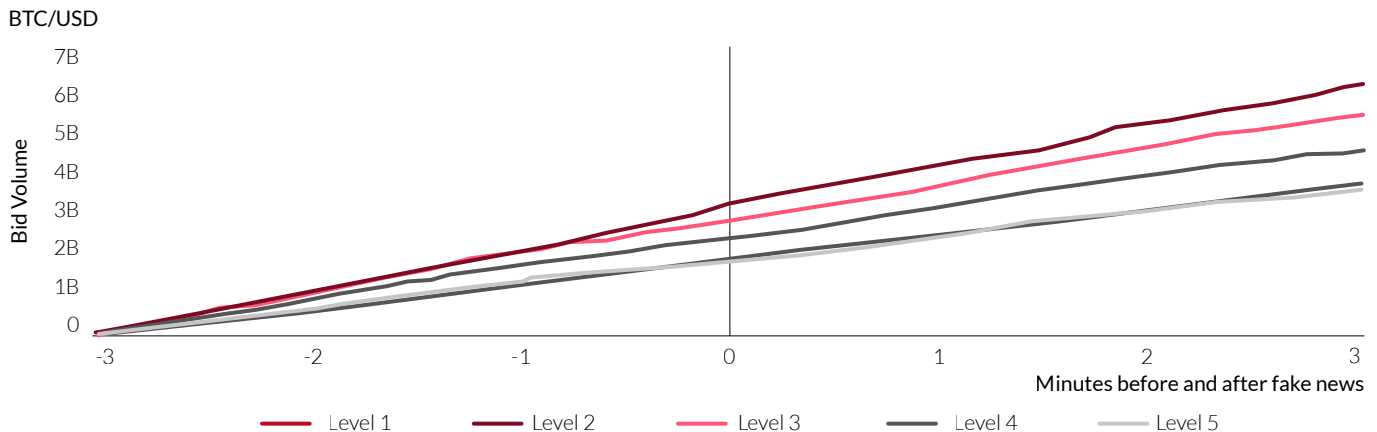


Chart 21



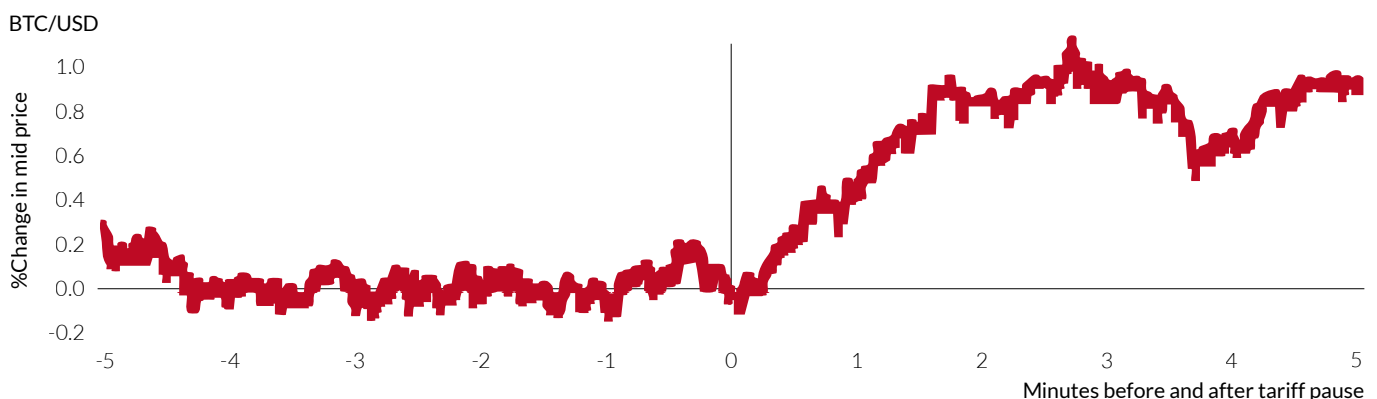
BTC/USD Reacts to Trump Social Media Posts

Trump's Truth Social post regarding his decision to pause tariffs on Mexico was made at 15:41 GMT, 3rd February 2024. Taking this to be the exact event time, we observe a very significant move upwards in BTC/USD beginning just seconds after the post, especially compared to the relatively low price action beforehand. In the first minute, BTC/USD moved 0.44% higher, indicating that the post was a driver of the price action (Chart 22).

Examining the trading volumes by depth, we notice a slight increase in the first few seconds after the post (Charts 23 and 24). However, while bid volumes remained mostly linear, with small jumps, ask volumes ramped significantly faster by the five-minute mark. This aligns with a reversal in the price trend starting at around 3 minutes post-event. The heightened level of market activity may be as a result of investors attempting to capitalise on the price jump following the event, with a sharp increase in sell orders as positions are liquidated.

There is evidence to suggest that the cryptocurrency market had moved due to Trump's Truth Social post, prior to more widespread media coverage.

Chart 22: BTC/USD mid-price, Trump posts about tariff pause



Charts 23 and 24: Cumulative Ask and Bid volume curves by depth, tariff pause

Chart 23

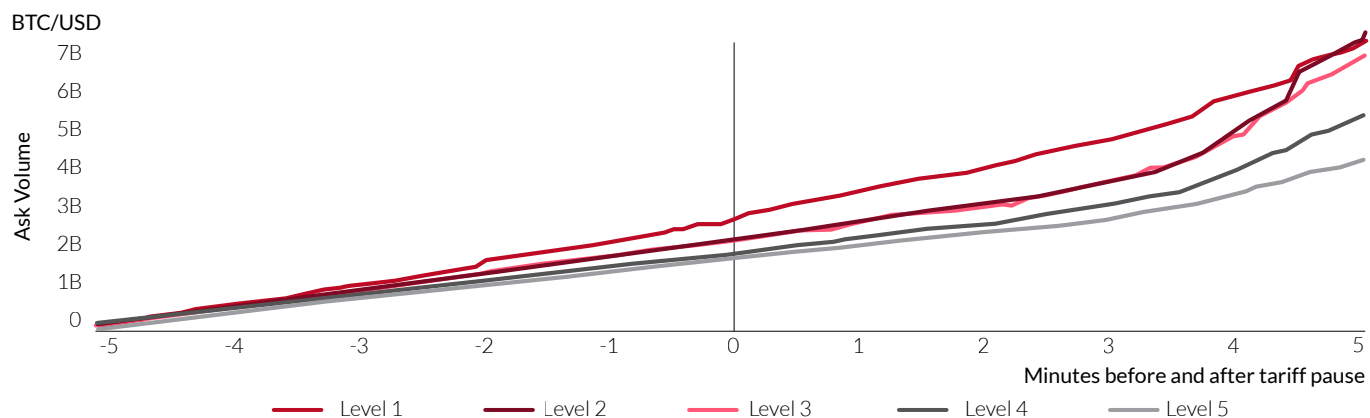
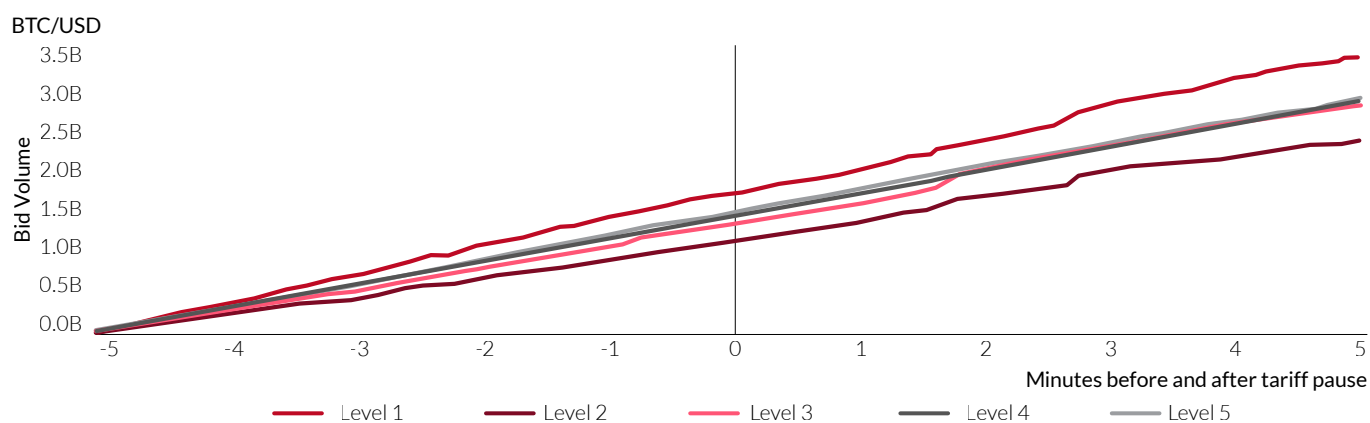


Chart 24





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