

Algo Toolbox Series

Dynamic POV: Beating the benchmark with an adaptive scheduled algo

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Dynamic POV: Beating the benchmark with an adaptive scheduled algo

Key takeaways

- **Dynamic POV** is an execution algorithm that builds on the traditional percent of volume strategy, using analytics from **Liquidnet Investment Analytics (IA)** to adapt the traditional POV strategy to respond dynamically to market conditions, while still tracking closely to the target participation rate.
- The algorithm uses signals from Liquidnet IA to identify when a dislocation between a stock and its correlated basket has occurred. Analysis suggests there is consistent mean reversion among Dynamic POV orders following shifts by the algorithm in an order's participation rate. Orders with shifts in their participation rate outperformed the PWP linked with their original target rate by **+6.1 bps**.
- Dynamic POV has demonstrated it tends to provide a similar controlled participation to a standard POV, but with measurably better performance.
- Dynamic POV performs well against key benchmarks, with a slippage versus arrival price of -1.0 bps and an outperformance of the Interval VWAP of **+1.3 bps**.
- Use of a Block Would overlay alongside Dynamic POV led to improved performance, with orders using the block overlay outperforming arrival by +.4 bps and the PWP linked with their original target rate by **+44.4 bps**.

Introduction

Liquidnet Dynamic POV is a scheduled algorithm that responds adaptively to market conditions. It targets a percentage of volume, but builds upon the traditional percent of volume strategy by speeding up or slowing down in response to price dynamics. Dynamic POV can be used in either momentum or reversion-based configurations, depending on trader preference and the nature of the orders being traded. The degree of deviation from the target POV can be calibrated, and defaults to minor adjustments based on a stock's volatility, on average still tracking closely to the original targeted participation rate. The default setting uses a reversion-based configuration with a basket of correlated stocks as the reference price. This anticipates that, on average, we will observe mean reversion of a stock toward its correlated basket. With this expectation the algorithm adapts its execution rate, slowing down when prices are expensive and speeding up when prices are more favourable.

Dynamic POV uses correlated basket analytics from Liquidnet Investment Analytics

The correlated basket is a collection of other stocks, typically seven, that are closely correlated with the stock in question. On an ongoing basis, Liquidnet Investment Analytics analyses the investible universe for the correlations between the trailing 60-day daily returns of each stock. Stocks are eliminated from the analysis if they are too closely related (i.e., holdings companies), if they are too illiquid, or if they are not listed in the same region. The results are then ranked, small bonuses are given for names in overlapping sectors and countries, and the top seven most highly scoring stocks become the correlated basket. Basket weights are determined via a statistical process that outputs the weighting that would minimize the variance of the basket's returns.

Correlated baskets for Adidas and Banco Santander are listed out below. As these baskets show, correlated baskets will often be cross-market and sometimes cross-industry, differentiating from and offering greater specificity than broad market or sector-based indices.

Table 1

| Adidas AG ADS GR | | | Banco Santander SAN SM | | |
|---------------------|--------------------------|-----------|---------------------------|---------------------------------|-----------|
| Name | | Weighting | Name | | Weighting |
| KER FP | Kering SA | 26% | BBVA SM | Banco Bilbao Vizcaya Argentaria | 22% |
| MC FP | LVMH SE | 20% | ACA FP | Credit Agricole SA | 20% |
| SFER IM | Salvatore Ferragamo SpA | 19% | BNP FP | BNP Paribas SA | 18% |
| BOSS GR | HUGO BOSS AG | 17% | INGA NA | ING Groep NV | 15% |
| CFR SW | Cie Financiere Richemont | 15% | ISP IM | Intesa Sanpaolo SpA | 15% |
| MONC IM | Moncler SpA | 13% | NDA DC | Nordea Bank Abp | 13% |
| PUM GR | Puma SE | 8% | EBS AV | Erste Group Bank AG | 13% |

Source: Liquidnet Investment Analytics correlated basket analysis with baskets as of November 2023. Bloomberg market data.

Dynamic POV performs well against key benchmarks

Dynamic POV is a scheduled algorithm that sources liquidity primarily in lit markets, with an option for the incorporation of a block overlay. Throughout the order life, the algorithm tracks the price evolution of the correlated basket relative to the price of the order. Price deviations between the correlated basket and the stock are intended to establish points of relative value, with the intention of overweighting or underweighting those points in the order life accordingly. The price deviation is considered in terms of several bands, which then determines the magnitude of any shift in the target participation rate. Calculations of the bands are made based on factors including the volatilities of the underlying instruments as well as the level of the original target participation rate.

Liquidnet analysed all Dynamic POV orders in EMEA over the period from January 1, 2022, to December 31, 2023. Dynamic POV's slippage versus arrival price was -1.0 basis point. This limited implementation shortfall is notable for orders with an average size of **8.4% of ADV** that were traded for **over an hour on average**. For a POV algorithm, it's important to consider performance against the VWAP that matches the intended order duration. This is captured using the Target PWP¹, which Dynamic POV outperformed by **+34.7 basis points**. The remainder of the paper will analyse the impact of the algorithm's shifts in participation rate as well as the impact of the block overlay. It is worth noting the impact of these features in headline performance, specifically the elevated participation rate and strong performance versus the interval VWAP. This is likely to be due to the impact of the block overlay, which can execute significant volume at advantageous points during the order life.

¹ PWP calculated using the original target rate of participation and an order size of either (1) the executed quantity if there is a follow-on order caused by an amendment to the order or (2) the target quantity if the order is standalone or if the order is the final order in its sequence

Table 2

| Order Characteristics | All Orders | Performance | All Orders |
|---------------------------------|---------------|------------------------------|------------|
| # Orders | 4,555 | vs. PWP Target (bps) | 34.7 |
| Traded Notional (\$) | 1,940,324,959 | vs. Arrival (bps) | -1.0 |
| Avg. order size (%ADV) | 8.4% | vs. Expected Cost (bps) | 27.3 |
| Avg. spread (bps) | 8.1 | vs. Interval VWAP (bps) | 7.4 |
| Avg. duration (min) | 70.2 | vs. Elig Interval VWAP (bps) | 1.3 |
| Avg. Participation Rate | 26.2% | vs. PWP10% (bps) | 13.9 |
| Interval Return (bps) | -11.1 | vs. Close (bps) | 7.3 |
| Expected Cost vs. Arrival (bps) | 26.3 | | |

Source: Liquidnet analysis of all EMEA Dynamic POV orders January 1, 2022, to December 31, 2023. Bloomberg market data.

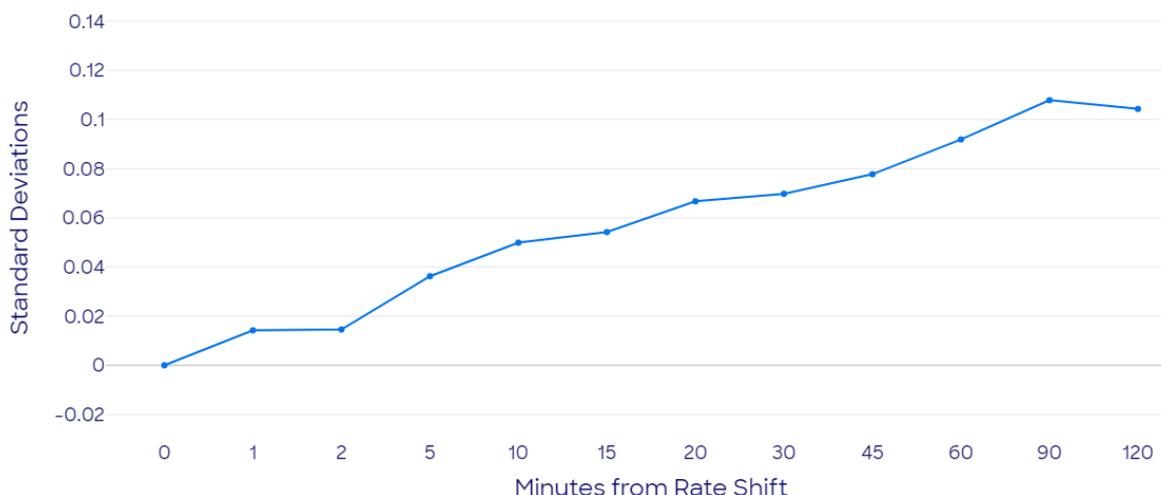
On average stock prices mean revert to the correlated basket after a shift in participation rate by Dynamic POV

Liquidnet analysed all Dynamic POV orders from January 1, 2022, to December 31, 2023, for instances of shifts by the algorithm to the target participation rate. Of 4,555 total Dynamic POV orders over the period, 1,884 orders, or 41.4%, had at least one shift in the target rate. The algorithm shifted the target rate a total of 6,655 times, or an average of 1.46 times per order. The algorithm shifts participation rate in response to price deviations between the order and its correlated basket. When used in reversion mode, it anticipates future price compression back toward the correlated basket. Liquidnet analysed price behaviour in the period following shifts in the target rate to establish the extent of mean reversion to the basket. All shifts in target rate in which the new rate was in force for greater than 1 minute were included in the analysis.

For each order, the VWAP of the stock and the weighted-VWAP of its correlated basket were calculated over one-minute bins over the trading day. For each instance of a shift in the target participation rate, the baseline price difference between the stock and its correlated basket was determined using the VWAPs of the minute bin during which the rate shift occurred. The evolution of this price difference was then considered across a series of mark-outs starting 1 minute and extending 2 hours after the rate shift. Price differences were normalized by the standard deviation of the delta between the stock and its basket over the full trading day. The average standard deviation was 52.8 bps. A positive number indicates price compression, or a decline in the price differential, between the stock and the correlated basket.

Figure 1

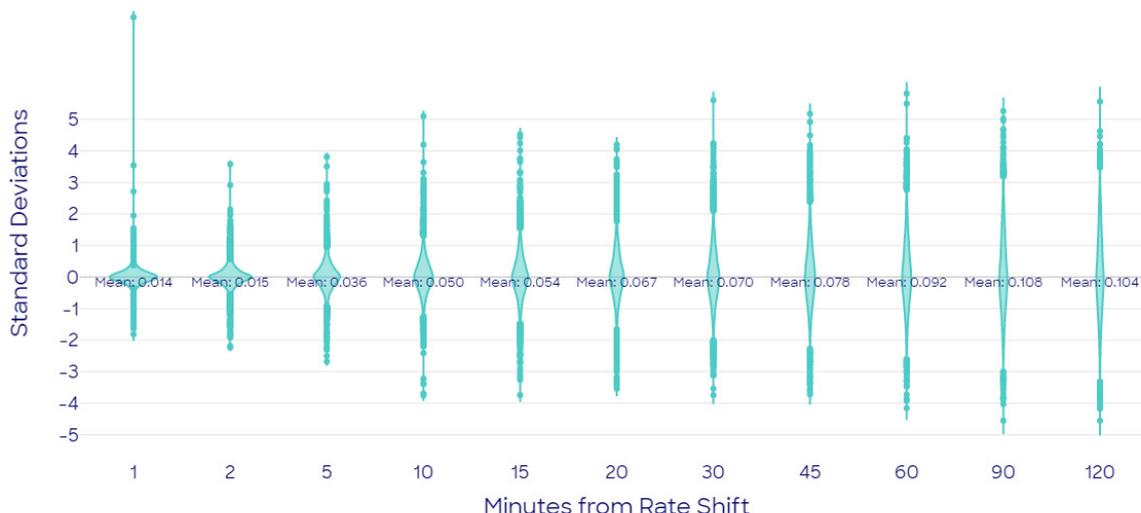
On average, the price of the stock reverts back toward its correlated basket following a rate shift



Source: Liquidnet analysis of EMEA Dynamic POV orders January 1, 2022, to December 31, 2023. Bloomberg market data.

Figure 2

As time from the rate shift increases, on average we observe consistent price compression despite an increasing dispersion of price movement

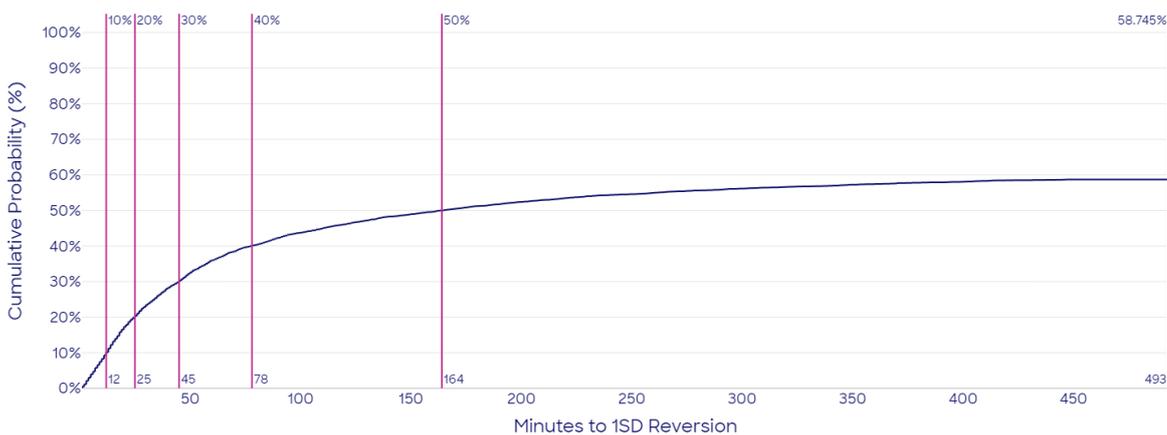


Source: Liquidnet analysis of EMEA Dynamic POV orders January 1, 2022, to December 31, 2023. Bloomberg market data.

Analysis shows consistent and increasing price reversion toward the correlated basket beginning soon following the shift in participation rate. For a Dynamic POV order operating in reversion mode, this should mean the shift in participation rate leads to executions at more advantageous price levels. Using a buy order as an example, analysis suggests that should the stock price rise beyond that of the correlated basket such that the algorithm reduces its target rate, the slower rate of execution should result in fewer executions until the point at which the delta has declined, at which point the algorithm might again increase the target rate. It is important to note that reversion against the basket is reversion in the context of beta, and may not always represent reversion in terms of absolute price-levels. As Figure 2 above shows, the dispersion of price evolution for any individual order can be wide and increases with greater distance from the rate shift.

Figure 3

The pace of price compression to the correlated basket can be rapid, with over 20% of orders having one standard deviation of reversion within half an hour



Source: Liquidnet analysis of EMEA Dynamic POV orders January 1, 2022, to December 31, 2023. Bloomberg market data.

On average, we observe consistent price compression at all mark outs. Of the sample of orders in which at least one rate shift occurred, 58.7% saw price reversion toward the correlated basket of at least one standard deviation over the course of the trading day. 10% of orders saw one standard deviation of reversion within 12 minutes, and 50% within 164 minutes. In more volatile markets, Dynamic POV may shift participation rate often in response to changing price dynamics between the stock and its basket. Given over 20% of orders see at least one standard deviation of price movement within half an hour of a shift in participation rate, it's important for the algorithm to be agile in providing a mechanism to both protect against and capitalize on that volatility.

Performance Impact of POV Laddering

To evaluate the effectiveness of Dynamic POV against a traditional POV algorithm, Liquidnet analysed Dynamic POV orders over the period January 1, 2022 to December 31, 2023 for their performance against the participation weighted price that matches the order's original target participation rate. Orders were further segmented into orders where a rate shift occurred and those where it did not. Note that orders where Block Would or Smart Blocks functionality was enabled were excluded from this analysis due to the potentially significant impact of block executions on order performance and participation rate.

Table 3

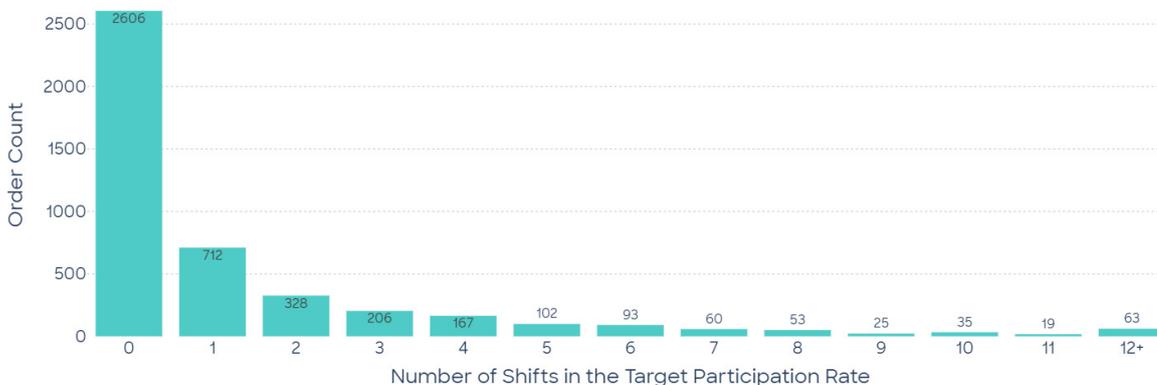
| Target Rate Shifted | Orders | Duration (min) | % of ADV | Part Rate | Int Spread bps | vs PWP Target bps | vs Elig Int VWAP |
|---------------------|--------|----------------|----------|-----------|----------------|-------------------|------------------|
| No | 1,613 | 21.5 | 0.8% | 9.9% | 7.4 | 0.4 | -0.9 |
| Yes | 875 | 100.6 | 2.0% | 10.2% | 9.3 | 6.1 | -0.3 |
| All | 2,488 | 63.3 | 1.4% | 10.1% | 8.4 | 3.4 | -0.6 |

Source: Liquidnet analysis of EMEA Dynamic POV orders not using Block Would January 1, 2022, to December 31, 2023. Bloomberg market data.

As an example, if the original target participation on an order was 10%, order performance is compared against the VWAP over the period of time corresponding to a 10% rate of participation. For a typical POV order, this would generally correspond to the actual realized order duration. For a Dynamic POV order, the algorithm may speed up or slow-down in response to market conditions, leading to a small difference in realized participation rate and order duration, and therefore exposure to a different price set. The sample of orders in which the participation rate changed outperformed the original target PWP by +6.1 bps, as opposed to +0.4 bps for the unchanged sample, suggesting the shifts to the target rate were accretive to order performance. It is worth noting that the expected performance of a static POV algorithm ought to be roughly in line with that of its target PWP, and to that extent the unchanged sample performs in line with expectations..

Figure 4

Dynamic POV makes targeted adjustments to participation rates, with most orders seeing minimal or no shifts



Source: Liquidnet analysis of EMEA Dynamic POV orders January 1, 2022, to December 31, 2023. Bloomberg market data.

Many orders will see a relatively small number of shifts in participation rate, however in certain cases the participation rate may change frequently, likely in response to more volatile markets. Dynamic POV introduces a proactiveness to a scheduled algo's approach to volatility, changing behaviour, if needed frequently, intra-order to capitalize on shifting market conditions.

Dynamic POV makes small and targeted adjustments to an order's participation rate, intending to overweight or underweight appropriate spots during the order life, without deviating significantly from the original Target POV. If we consider all orders excluding those using Block Would and those under five thousand dollars notional, we can see the average realized participation rate does not deviate too significantly from that of original target rate on the orders, regardless of how many rate shifts may have occurred.

Table 4

| POV Shifted | Average Realized POV | Average Original Target POV |
|-------------|----------------------|-----------------------------|
| No | 12.7% | 10.5% |
| Yes | 10.0% | 10.8% |

Source: Liquidnet analysis of EMEA Dynamic POV orders January 1, 2022, to December 31, 2023. Bloomberg market data.

Some deviation from the intended participation is expected using a standard POV strategy, and this is true with Dynamic POV as well. Dynamic POV tweaks participation in a risk-controlled manner to improve performance without sacrifice too much of the predictability of a standard POV strategy.

Dynamic POV with Block Would outperforms both arrival price and the Target PWP

Dynamic POV can be used alongside either a Liquidnet Smart Blocks or a Block I Would overlay. The block overlay combines conditional block seeking logic with the POV algorithm, capturing block liquidity if it presents, all while trading on-schedule in lit markets. For greater detail please see the Algo Toolbox Series piece on Smart Blocks. The effect of the block overlay is to reduce price risk while increasing liquidity capture, combining the predictability of scheduled trading in lit markets with the opportunism of block seeking.

Liquidnet analysed all Dynamic POV orders over the period January 1, 2022, to December 31, 2023, segmenting orders by their Block Would status. All orders in which at least one child order was sent to a block destination, regardless of whether or not a fill occurred are included in the “Y” category. Orders with Block Would activity outperformed those without Block Would activity on the basis of slippage versus the Interval Eligible VWAP and versus the order’s target PWP. This is despite the block-eligible sample being significantly larger, with an average order size in ADV terms more than 5x greater.

Table 5

| Block Would | Orders | Duration (min) | % of ADV | Part Rate | Int Spread bps | vs PWP Target bps | vs Elig Int VWAP |
|-------------|--------|----------------|----------|-----------|----------------|-------------------|------------------|
| No | 2,552 | 50.3 | 1.9% | 11.4% | 8.3 | 3.1 | -0.5 |
| Yes | 2,003 | 95.6 | 10.5% | 30.8% | 8.1 | 44.4 | 1.8 |
| All | 4,555 | 85.0 | 8.4% | 26.2% | 8.1 | 34.7 | 1.3 |

Source: Liquidnet analysis of EMEA Dynamic POV orders January 1, 2022, to December 31, 2023. Bloomberg market data.

Combining the liquidity seeking behaviour of the block overlay with the adaptiveness of Dynamic POV logic in lit markets achieves strong results. The participation rate of 30.8% demonstrates the block overlay’s ability to dramatically increase liquidity capture relative to what would be possible in lit markets alone, all while achieving limited impact cost, with cost versus arrival price not just near zero, but slightly positive². In considering the effectiveness of the block overlay it’s important to evaluate price behaviour after the block. This measures the opportunity cost of transacting the block relative to trading those shares more slowly over time. The Block Would sample outperforms the Target PWP by +44.4 basis points, suggesting that the block overlay when used by Dynamic POV is effective at sourcing blocks at advantageous price points relative to later price levels.

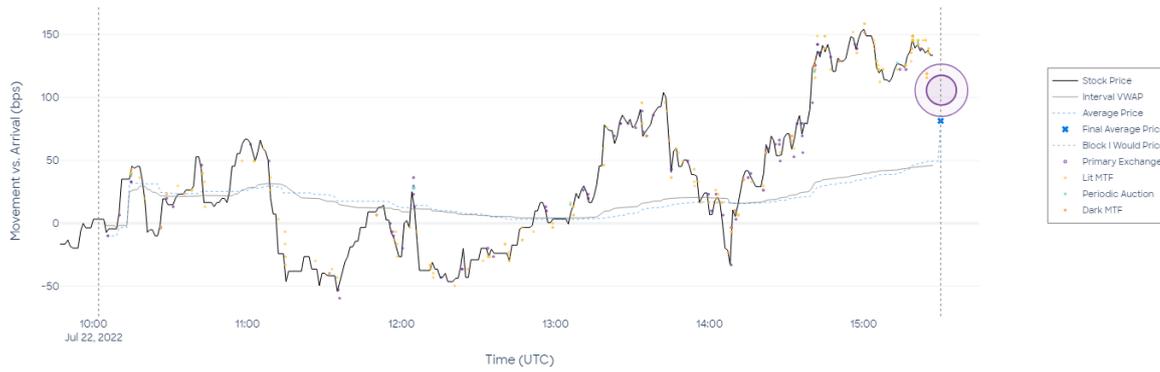
Dynamic POV is an adaptive execution algorithm designed to be responsive to market conditions. It is highly customizable, with options to incorporate block overlays, forming a key piece of the trader’s tool kit.

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² Dynamic POV orders using Block Would performance versus arrival was +.4 bps. For those not using Block Would it was -5.7 bps.

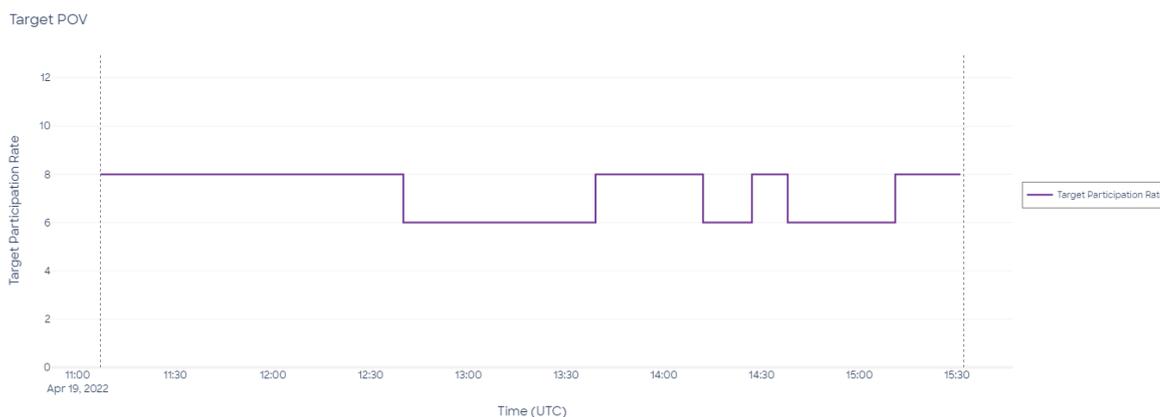
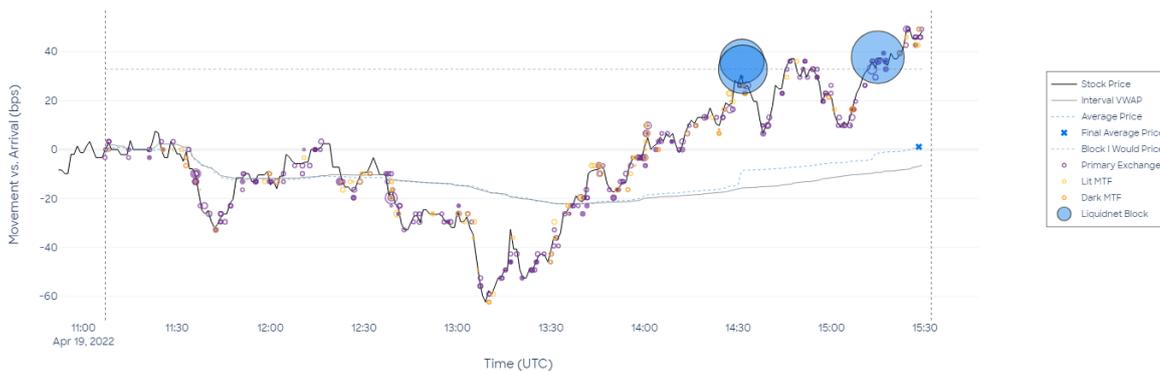
Case Studies

I. An adaptive scheduled algo, tailoring execution rate to relative value



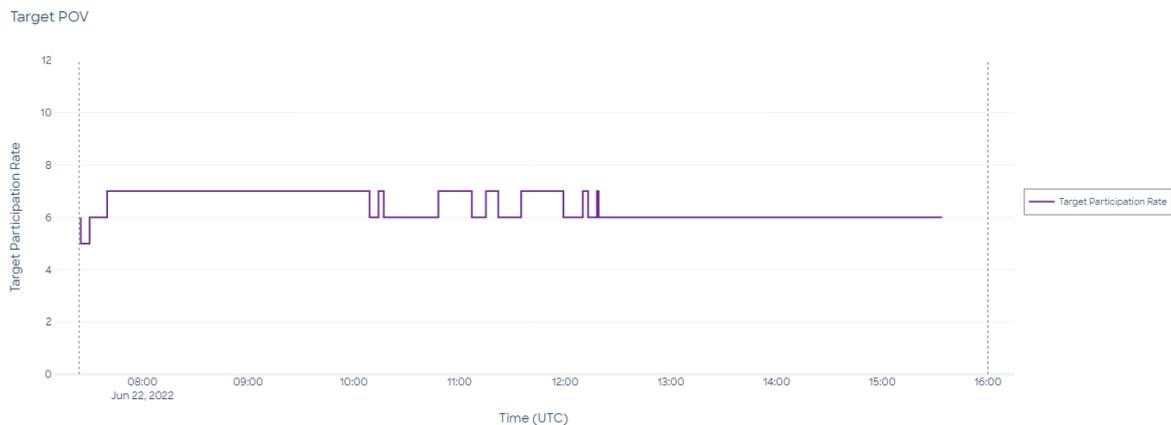
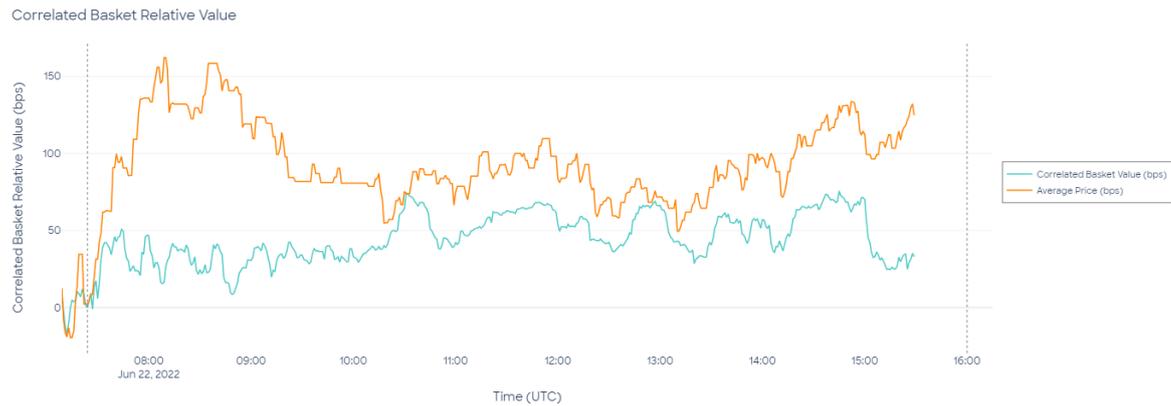
This \$1.5M buy order of an Irish Large Cap was, like many orders in scheduled algos, traded over the day. The order's original target participation rate was 8%, with the algorithm shifting the target rate 16 times throughout the order life in response shifting relative value. It was a relatively volatile day, with the intra-order range on the stock exceeding 2% and the standard deviation of the basket-stock price delta reaching just over 70 bps. The order's first eight rate shifts all saw future price compression toward the correlated basket of at least one standard deviation. In these more volatile conditions, Dynamic POV's adaptiveness can help execute at more favourable price levels. The order outperformed the target PWP (PWP 8%), by 8 bps and had a realized participation rate of 6.1% of volume, indicating that the algorithms alignment of execution rate, leading to a slightly slower rate of overall participation, with relative value was accretive to performance.

II. Out of the money Block Would complements adaptive over the day trading



In this \$1.2M sell order of a UK Large Cap, Dynamic POV executed 2.6% of ADV gradually over day at an average participation rate of 5.9% of volume. The target participation rate began at 8% and oscillated several times down to 6% at those points at which the stock price fell relative to the correlated basket. Throughout the order, the trader had a Block Would set about 30 bps above the arrival price. The order traded below that level throughout the morning and early afternoon, but crossed higher leading into the close, resulting in three Liquidnet block executions (comprising 12% of the order). The block executions were highly additive to order performance, occurring well above the trailing slippage versus arrival and interval VWAP. Dynamic POV underweighted the period time from roughly 12:30pm to 1:45pm when prices were most disadvantageous, with the block overlay helping source dark liquidity and even more aggressively capitalize on the better prices available in the late afternoon. The use of an out of the money limit on the block overlay can maintain overall participation rates at more passive levels while still allowing for liquidity capture at more favourable price levels should they present.

III. Accelerating over the day trading with block liquidity capture



This \$3.7M sell order of a French Mid was traded over much of the trading day with Dynamic POV originally targeting a POV of 6%. Soon following the start of the order, the price of the stock rose significantly relative to that of its correlated basket, and remained elevated for the next two hours. Dynamic POV increased participation to 8% during that time to capitalise on the more favourable conditions. The overall order size was 23.2% of ADV, typically too large a quantity to trade over the day at that rate of participation, or even over the day at any rate of participation especially without significant impact in lit markets. The block overlay was active during the whole of the order, limited well below current levels. Around 10:30am a large \$2.1M Liquidnet block execution transacted, representing 13% of ADV and more than half of order notional. The interplay between the block liquidity seeking overlay and Dynamic POV's behaviour in lit markets helped drive a 20% outperformance of the target PWP (6%) as well as a healthy 84 bps outperformance of arrival despite the realized 23% participation rate.

