# Navigating Conditional Orders

## Solving the ironic challenge of increasing choices

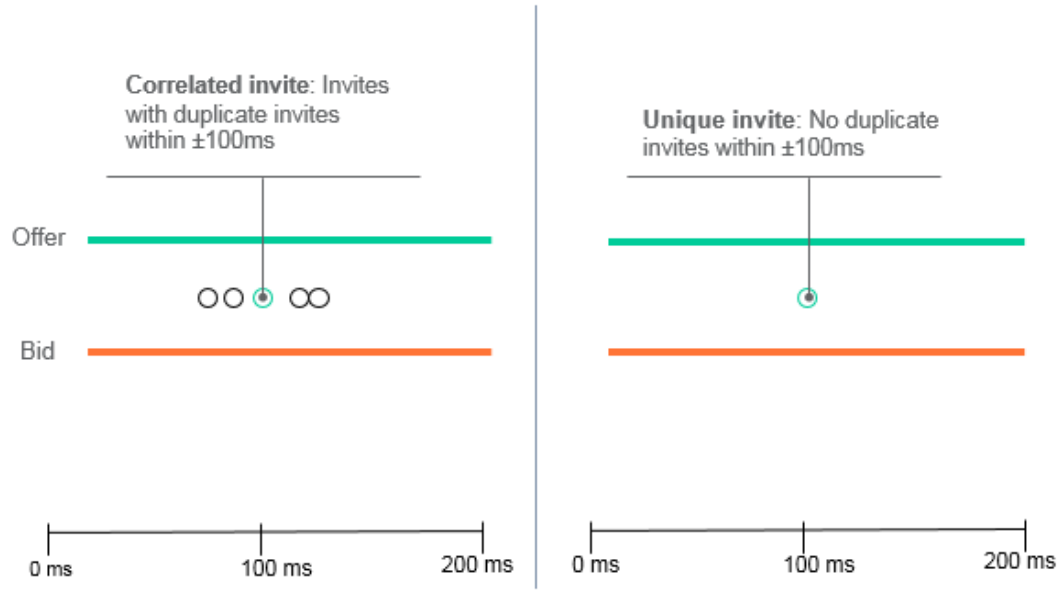
Once dominated by human traders, conditional order types have become widely used by both buy-side and sell-side routers as an important means of sourcing block liquidity in Alternative Trading Systems (ATSs). Additionally, the number of ATSs offering conditional order types has increased dramatically over the past few years and this growth has contributed to the fragmentation of block-seeking order flow, resulting in a lack of truly unique block liquidity in certain venues. Moreover, as in any fragmented market, speed has become increasingly important, giving the venue with the lowest latency the highest probability of receiving the execution. This evolution has important implications not only for order routing, but also for the sufficiency of traditional execution quality metrics, such as firm-up rates.

**DATA**

The observations in this paper are sourced from execution data generated by Virtu's U.S. Covert Neutral algorithm. Covert Neutral seeks hidden liquidity with both firm and conditional orders at midpoint. When routing conditional orders, Virtu's order router sends resting conditional orders to venues on a staggered basis; whereby, orders are placed on venues one at a time with a small delay between each placement. The time frame analyzed is from November 2018 through February 2019. Direct exchange market data is used for all price and quote data.

An invitation from a conditional order is defined as unique if Virtu's router does not receive a duplicate invitation within 100 milliseconds (i.e. 1/10th of a second) of another conditional invite. Conditional invites received within the ±100ms band are considered non-unique, or a correlated invite. Figure 1 provides a graphical representation of the difference between correlated and unique invites.

**Figure 1: Correlated Invite Illustration**




Illustrative purposes only

## DIFFERENTIATED LIQUIDITY AND VENUE LATENCY

When agency algos seek block liquidity via conditional order types in multiple venues, quite often the invitations that are received are non-unique invites. The following screenshots[1] illustrate what Virtu's conditional order router regularly encounters.

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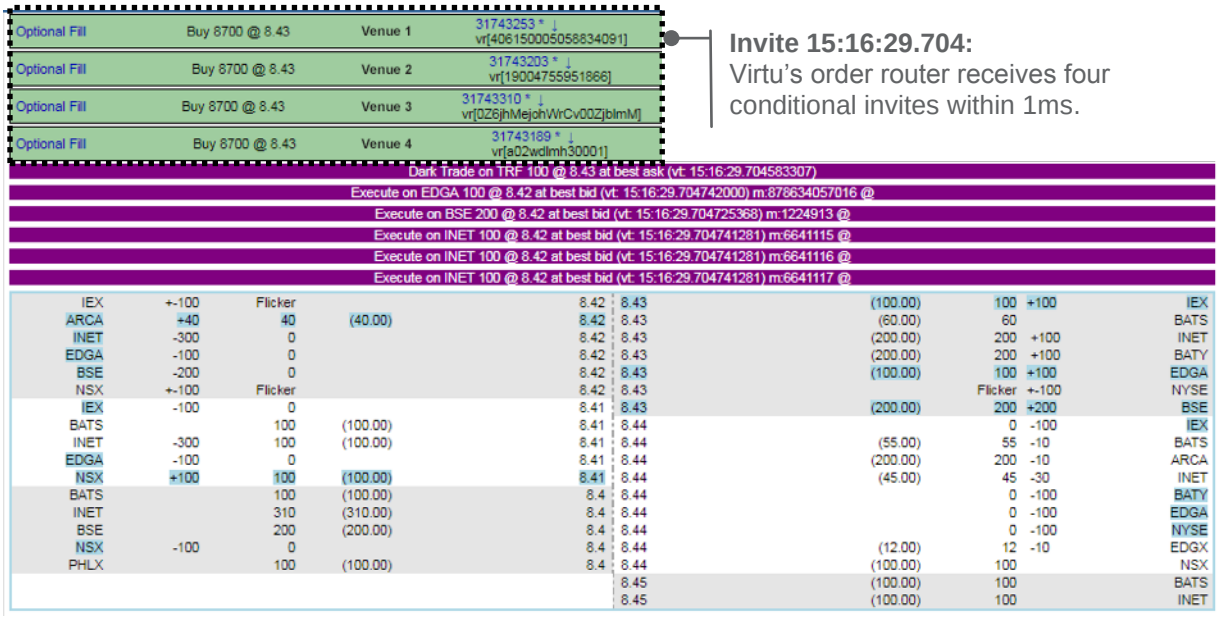
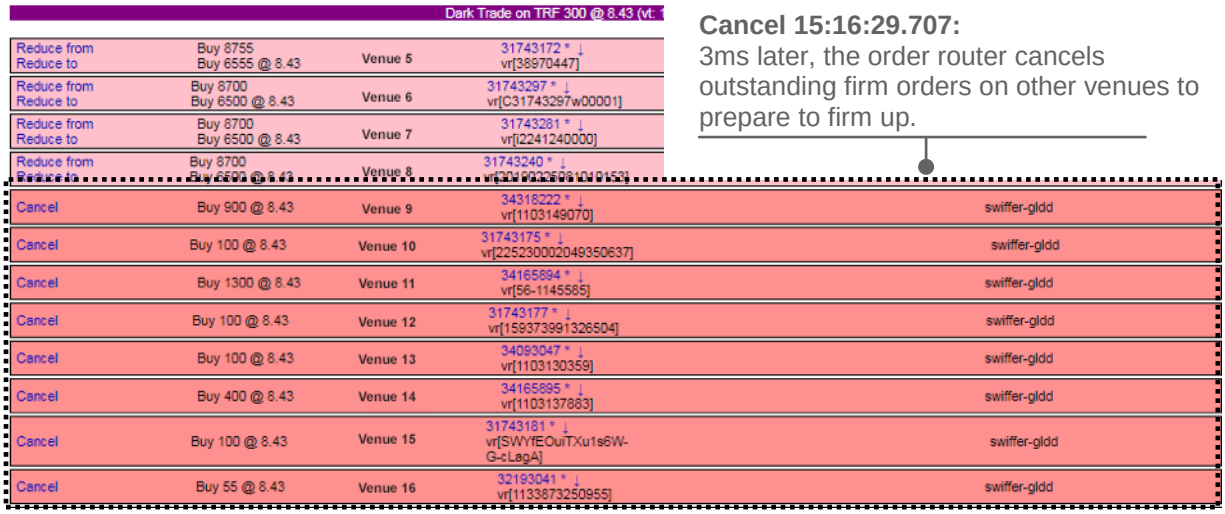
**Figure 2: The Sequence of Events that Lead to a Conditional Fill, Viewed through Virtu's Proprietary Market Data Replay Tool**

### A. The router receives four near-simultaneous invites



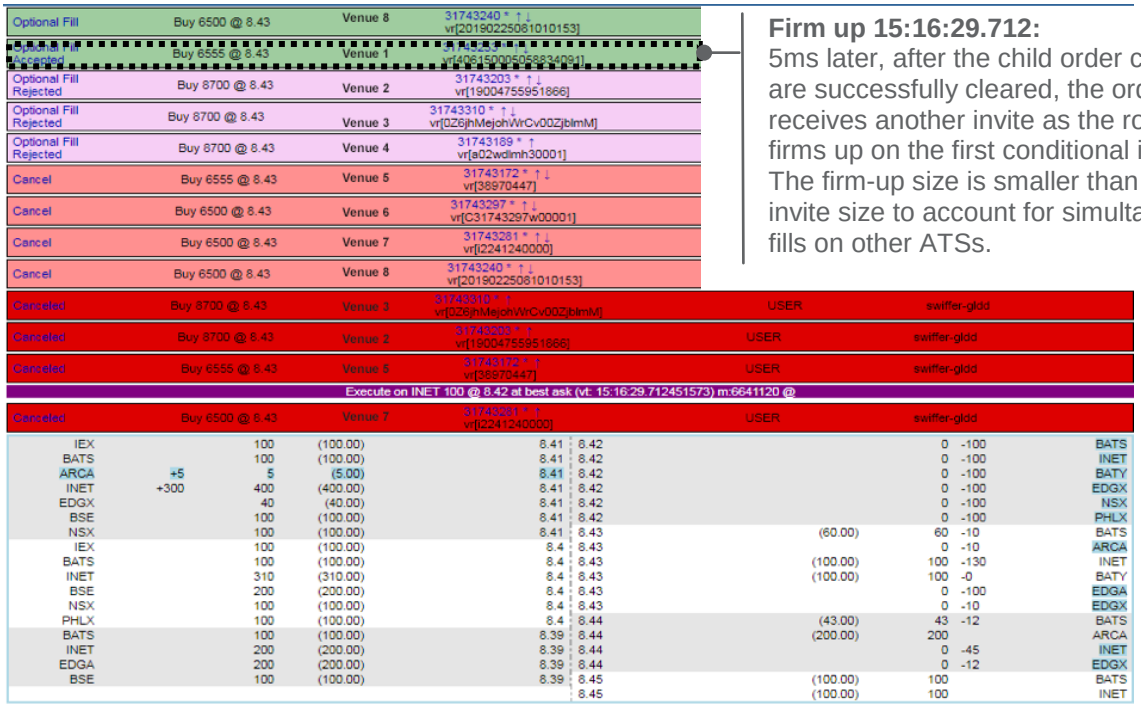

[1]The images were taken from Virtu's proprietary market data replay tool, which combines direct exchange feed data and Virtu's proprietary order-routing decision-making algorithm.

## B. The router sends a number of near-simultaneous cancel messages to other venues



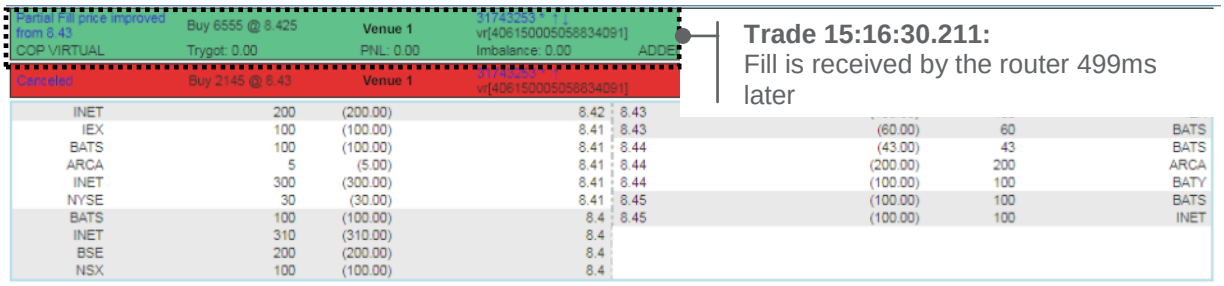

**Cancel 15:16:29.707:**
3ms later, the order router cancels outstanding firm orders on other venues to prepare to firm up.

## C. The router accepts the first firm-up request that it receives




**Firm up 15:16:29.712:**
5ms later, after the child order cancels are successfully cleared, the order router receives another invite as the router firms up on the first conditional invite. The firm-up size is smaller than the invite size to account for simultaneous fills on other ATSs.

### D. The router receives an execution message from the venue that was selected in C




Source: Virtu's proprietary market data replay tool

This illustration highlights the fragmentation that exists for conditional order routing, particularly when the order router receives multiple conditional invites and simultaneous fills from firm orders at other venues.

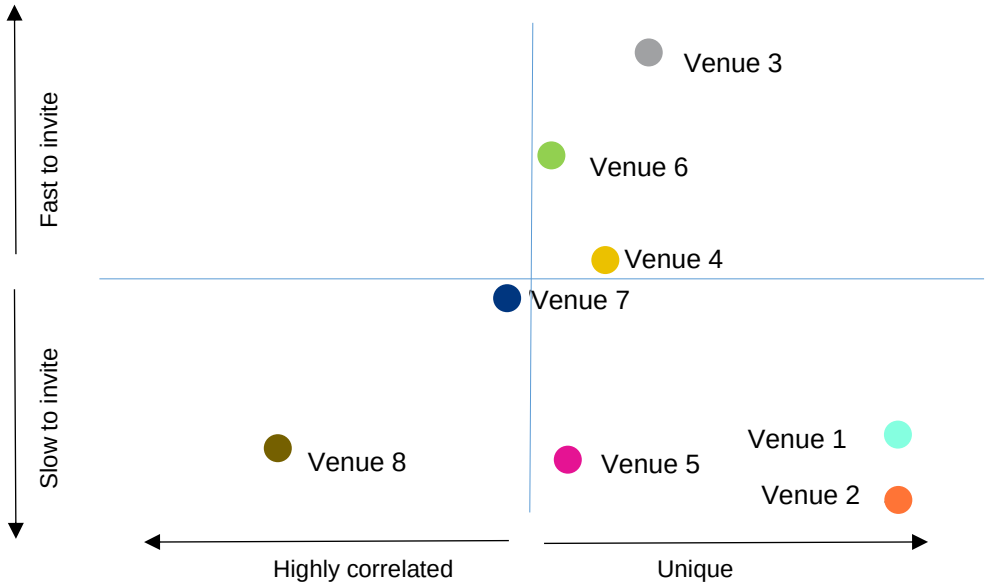
The images also highlight the need for market participants to expand the common evaluation criteria for conditional venues beyond metrics such as firm-up rates or average trade sizes. The data suggests that participants should identify venues that differentiate themselves either by having truly unique liquidity or by sending conditional invites faster than other venues. Virtu's conditional order router typically accepts the first invite it receives; assuming other routers operate in similar fashion, a conditional venue can succeed even with a lack of unique liquidity.

The following matrix evaluates the conditional venues to which Virtu routes across two dimensions: uniqueness of the venue's liquidity and speed of the venue. Venue uniqueness[2] is the percentage of time the router receives an invite only from that venue—therefore the higher the percent/the more instances we see a singular invite from a particular venue—the more unique it is. Venue speed is the probability that the particular venue arrives first with its invite, in instances where the Virtu order router receives more than one conditional invitation.

Venues 1 and 2 separate themselves from the other venues regarding liquidity uniqueness. Venues 3 and 6 differentiate themselves by speed. In our measurement framework, Venue 8 is the clear laggard, as it provides the least amount of unique liquidity and is one of the slowest venues.

[2] An invitation from a conditional order is defined as unique if Virtu's router does not receive another invitation within 100 milliseconds (1/10th of a second) before or after the conditional invite. If the router receives another invite within the ±100ms band, then that invite is considered non-unique, or a correlated invite.

**Figure 3: Conditional Venue Performance Quadrants**



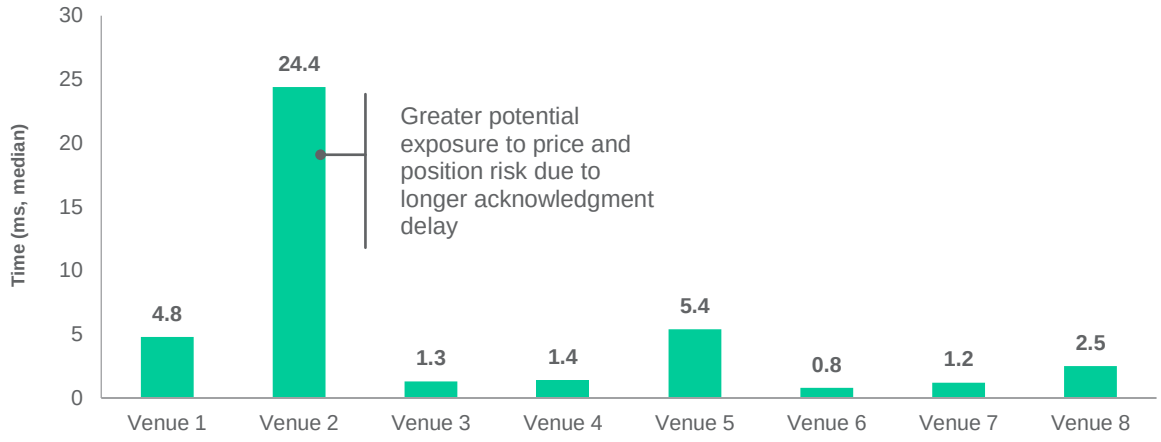

The Slow/Fast-to-invite metric represents the probability that we receive an invite from a specific venue first, given multiple invites.

Source: Covert U.S. conditional fills November 2018-February 2019.

Confirmation speed is the time between the moment that Virtu's router accepts a conditional invite by sending a firm order to the conditional venue (Step C in Figure 2) and the moment Virtu's router receives an execution message (Step D in Figure 2). A venue's confirmation speed is also important to analyze as delays in response time can lead to increased price risk (i.e. the longer the delay, the greater the potential for the market price to move away during the delay) and position risk (e.g. should Virtu's router cancel during the delay to mitigate the risk of being out of the market?).

The following figure provides the median response time from the conditional venues in the dataset. While most conditional venues respond with execution messages within 2ms, Venues 1, 5 and 2 show large delays, which can degrade execution performance for the reasons previously discussed. Interestingly, these three venues are also generally the slowest venues when sending invites to participants, as illustrated in Figure 3.

**Figure 4: Median Time from Firm-Up to Trade Confirmation**




Source: Covert U.S. conditional firm-ups and fills, November 2018-February 2019

## CONCLUSION

Conditional orders are a useful tool to source block liquidity, which is especially helpful in less liquid securities; however, the proliferation of conditional order routers and the number of venues that offer conditional order interaction has increased fragmentation of block liquidity. This evolving world of conditional order flow has interesting implications for performance evaluation and order routing behavior.

**Performance measurement:** Using firm-up rates to measure quality within a conditional venue (a metric commonly used by market participants) is no longer sufficient. For example, Venue 2 might view Broker X's order router as poor due to a lack of firm-ups; however, this is not necessarily an indication that Broker X does not want to accept the Venue's orders, but simply a byproduct of Venue 2 sending invites after Broker X's router has already received and accepted conditional invites from other venues (see Figure 3). Additionally, the probability of both participants to a potential trade sending their firm orders to the same venue decreases if both parties are not using the same heuristic response method. If the same method is not used, the two parties could route their firm-up orders to different venues, resulting in a missed execution. This missed execution is not due to either party backing away, but to the fragmentation that exists in the conditional market.

**Order routing and execution performance:** Certain conditional venues appear to offer redundant liquidity and introduce operational complexity to the equation. The data suggest that removing venues that are not unique and are slow appears to improve fill rates more than simply routing to all conditional venues.

**Sequencing venues when routing conditional orders on a staggered basis:** Venues that offer more unique liquidity should be placed higher on the staggering list in order to target unique liquidity opportunities before expanding to more correlated venues, where the risk of not receiving a fill increases due to the scenarios outlined previously.

**CONTACT**

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