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When the going gets tough, the tough get going

A look at rates market liquidity through data releases

- We take a granular look at intraday liquidity heading into various morning data prints and FOMC meetings, to explore market resiliency and implications for volatility
- Without fail, market depth plunges into employment reports and FOMC statement releases, as volume surges and price impact rises; this momentary lapse in liquidity is largely driven by HFT participants, who mostly vacate the order book
- While market depth has grown in fits and starts over recent years, we find the "bedrock liquidity" persistent through data releases has remained roughly unchanged
- Depth has taken longer to recover in recent years, often taking 30-60 minutes post payrolls to reach its pre-release average
- FOMC meetings likewise see a drop in market depth that fails to recover in the hours following the statement release and into the presser; despite elevated volumes, this is coincident with elevated realized vol post-statement
- While payrolls is easily the most acute data event, it is by no means unique: preliminary GDP estimates, ADP employment reports, CPI prints and ISM surveys all form a middle tier of liquidity drawdown events

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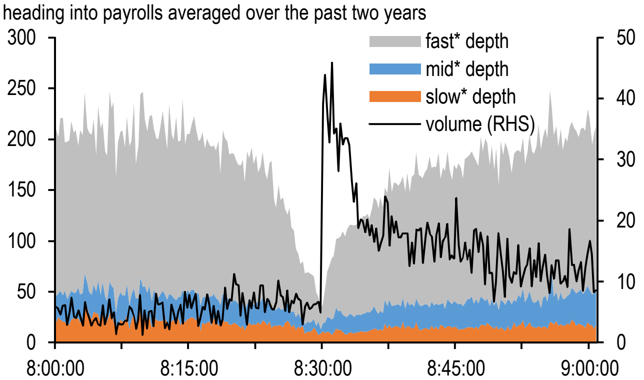
As rates markets navigate yet another inflection point in Fed policy, and their reaction function turns more data-dependent, **we deem it prudent to keep tabs on how markets react to various economic releases. Here we look at recent data prints from the perspective of market microstructure and liquidity**, to help inform how vol should be priced surrounding these events. As our colleagues in Treasuries have recently highlighted, the most impactful data prints for the yield curve to continue to evolve, with recent focus having shifted away from employment metrics and towards indicators typically associated with early warning signs of economic trouble, such as ISM manufacturing and retail sales prints (see Treasuries, *US Fixed Income Markets Weekly*, 10/1/19).

Exhibit 1: Market depth plummets into 8:30 am data releases, led by faster (presumably HFT) participants, who mostly vacate the order book; in contrast, volume surges following the print

Market depth* (LHS; $mn) and traded volume† (RHS; $mn) in 10-year Treasures heading into payrolls averaged over the past two years



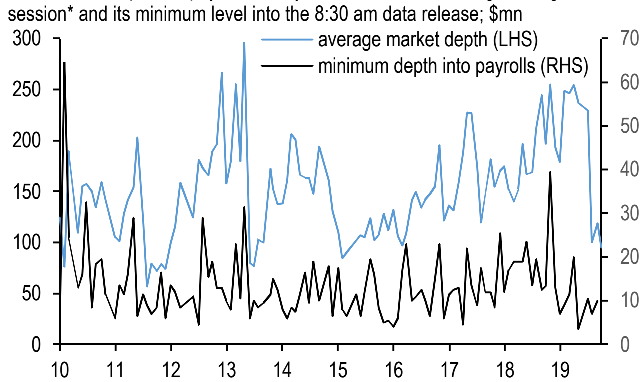
* We define market depth as the total notional available at the best three price levels, averaged across the bid and ask sides of the stack for on-the-run Treasuries; we take a snapshot of this metric for every $50mn of traded notional, and average these observations over the past two years of payroll prints in 15-second increments through the day. We further break out market depth based on the reaction speed of various anonymous participants in the order book. **Fast** denotes participants who update their orders faster than 0.3 milliseconds (typically a few microseconds). **Mid** denotes reaction speeds of 0.3 to 30 milliseconds. **Slow** denotes reaction speeds slower than .03 seconds.

† Traded volume in hot-run 10-year Treasury notes on payrolls days is stacked over the past two years and then averaged in 15 second increments.

Source: J.P. Morgan, BrokerTec

Exhibit 2: While broader market depth during normal trading hours has grown in fits in starts over recent years, the "bedrock liquidity" present into data releases has remained roughly constant

Total market depth* on payrolls Fridays as observed on average throughout the NY session* and its minimum level into the 8:30 am data release; $mn



Source: J.P. Morgan, BrokerTec

Data releases and FOMC meeting dates represent a fascinating laboratory for probing microstructure, as a brief moment of the day can involve a rapid drawdown in the order book, a surge of trade volume, and a violent gapping in price action. To see this in action, **Exhibit 1** charts market depth and volume in 10-year Treasuries in the hour surrounding payrolls releases over the past two years. In the minutes leading into 8:30 am, screen depth at the best three prices collapses to less than a quarter, on average, of its pre-print base level. **As we've highlighted in the past, this pullback in liquidity provision is primarily due to an outsized drawback among high-frequency trading firms (HFTs)**, whom we identify via their rapid reaction to other changes in the order book (on order microseconds, see *Far from the shallow now?* M. Salem et al., 4/12/19, and *Where have all the cowboys gone?* M. Salem et al.,

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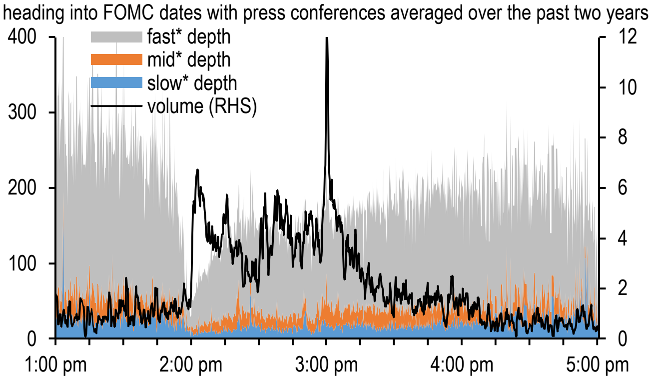
8/14/19). While the fastest players in the book reduce their presence by roughly an order of magnitude, the slowest-reacting participants (presumably human traders at large broker-dealers) maintain a much more robust presence, reducing their exposure by less than 70%.

While fast-reacting participants are loathe to *provide* liquidity into data releases, they remain quite a large share of trading volume through the print. By our estimates, likely HFT participants represent a roughly constant share of aggressor activity (and therefore traded volume) throughout the 8am-9am period on payroll dates. Perhaps most notably, this share is not at all different from other days that do not include significant data prints. This suggests that total HFT activity on the aggressor side of the market actually *increases* along with broader volumes in the wake of major releases. Thus while these players fail to provide a resilient source of market depth, they remain a large share of the flows that serve to push prices around as the market digests the new economic data.

Observing this behavior over a decade of payroll prints, we find that while overall market depth in rates market has grown markedly in recent years, **the "bedrock liquidity" that remains present through the heart of these data releases (and, presumably myriad other market stress events) has remained roughly constant**, at a small fraction of the total book **(Exhibit 2)**. Tellingly, while market depth has remained stubbornly low in the past couple months, on average, this baseline liquidity level has been roughly constant through the past three payroll prints. This brings us to the perhaps surprising conclusion that broader market depth dynamics in the days surrounding data releases have little impact on the liquidity in the thick of the moment.

Exhibit 3: On FOMC meeting dates, all participants pull back liquidity provision, but again led by HFT participants; depth fails to recover post-statement, despite elevated trade volume …

Market depth* (LHS; $mn) and traded volume* (RHS; $mn) in 10-year Treasures heading into FOMC dates with press conferences averaged over the past two years

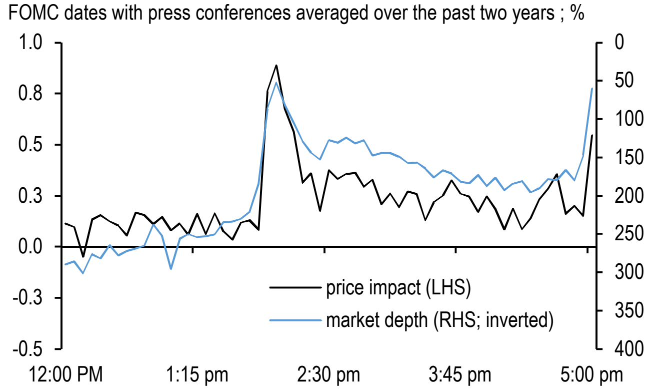


* See **Exhibit 1** footnote for how we compute both market depth and volume

Source: J.P. Morgan, BrokerTec

Exhibit 4: … persistent low depth following the statement release and through the press conference is matched by persistently elevated price impact

Price impact* (LHS; ticks/$50mn) and market depth (RHS; $mn; inverted) through FOMC dates with press conferences averaged over the past two years ; %



† Price impact defined as the observed average price move per $100mn of traded volume. The sign of the move is corrected for flow imbalance (positive for a price increase when buys outnumber sells, and negative when sells outnumber buys). For details, see Drivers of price impact and the role of hidden liquidity, J. Younger et al., 1/13/17.

Source: J.P. Morgan, BrokerTec

A similar dynamic emerges upon inspecting FOMC meeting dates. Here, depth again comes crashing down into the 2pm statement release, and again the fastest participants in the order book play an outsized role in this drawdown—certainly in an absolute sense, but also as a percentage of total depth (**Exhibit 3**). Unlike in the case of 8:30 am data releases, depth never truly recovers to its pre-release levels. In

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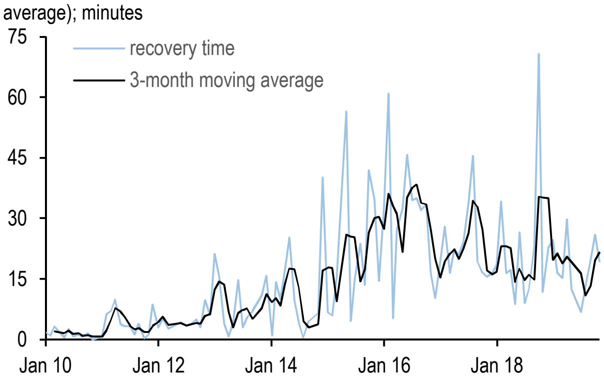
contrast, volume doubles, on average, post-meeting. **Persistently low market depth following the FOMC statement release and through the presser into market close is matched by persistently *elevated* price impact**—roughly a factor of two higher, on average, than the hours leading into the meeting (**Exhibit 4**). This follows on to realized volatility, which is in turn roughly twice as high, on average, as pre-meeting. Here it's hard to disentangle cause and effect. As we've highlighted in the past, low market depth is in part caused by higher volatility, as HFT programs have shown a longstanding habit of reducing exposure in the order book when vol rises. Thus elevated price impact is likely both a reflection of lower depth but also a cause of these unfavorable liquidity conditions.

Turning back to payrolls, we can ask a slightly different question of the order book: **how long does it take for market depth to recover post-release**? While gapping price action in the heat of the moment is of course impactful for volatility, elevated flows in the hours following the release continue to bombard the order book, enhancing realized volatility and thus making a fast recovery of liquidity crucial to broader orderly price discovery. To answer this question, we record how long it takes overall market depth to recover to its average level between 8:00 and 8:15am. **This metric has grown from a minute or two early in the decade to 15-30 minutes in recent years (Exhibit 5)**. On the worst days in our data set, it has taken an hour-plus for the order book to pull back to its pre-release level—a level that itself is notably lower than where depth typically sits in mid-morning New York time.

Exhibit 5: The recovery time of market depth following data releases has grown longer in recent years, allowing disorderly price action to linger in recent years, amidst elevated trade volume

Recovery time for market depth following 8:30 am payroll prints (rolling quarterly average); minutes

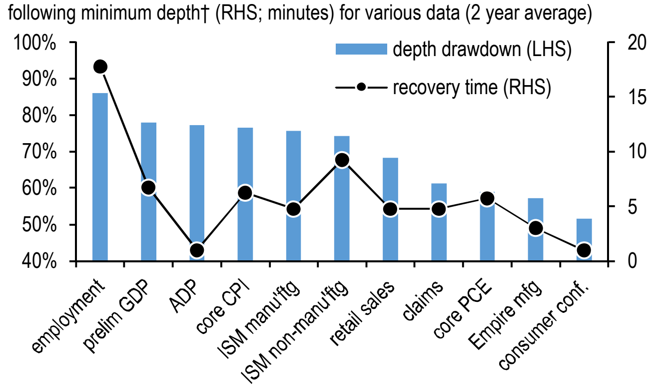


* We define **recovery time** as the minutes after 8:30 am until market depth has recovered to its average level between 8:00 and 8:15 am (prior to the drop). Note depth typically plateaus at measurably higher levels in the mid-morning session, so this is an imprecise metric that if anything underestimates true recovery time.

Source: J.P. Morgan, BrokerTec

Exhibit 6: An acute drop in market depth is not unique to payrolls or FOMC dates, though the employment data release is the worst offender in terms of both magnitude and duration

Drop in market depth heading into data releases* (LHS; %) and recovery time following minimum depth† (RHS; minutes) for various data (2 year average)



* Drop in market depth defined as the percentage drop in depth from the average from 30 minutes to 15 minutes before the data release into the minimum observed level of depth (typically a very brief instant just following the print), for example going from $200mn to $20mn is a 90% drop.

†See Exhibit 5 footnote for definition of recovery time

Source: J.P. Morgan, BrokerTec

While this note has mostly focused on just two complementary events (morning payroll prints and afternoon FOMC statements), there are numerous other events during the day that lead to acute liquidity supply (and occasionally demand) shocks. **Looking across standard economic data releases, we find the employment reports are by no means unique, though they do represent the worst offenders**, in terms of both magnitude and duration of the liquidity pullback (**Exhibit 6**). Preliminary GDP estimates, ADP employment report, CPI and both ISM surveys fill out a middle tier of drawdown events. **What all these events have in common:**

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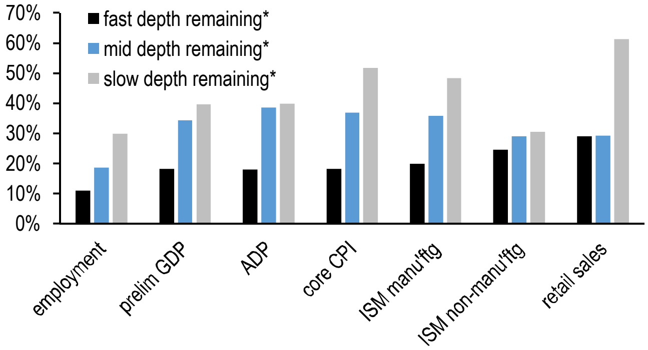
likely HFT participants form a disproportionate share of the drawdown, not only due to their enormous presence in the book, but also due to a more dramatic pullback, in percentage terms, into these events (**Exhibit 7**).

Exhibit 7: A common feature of depth dynamics across all data releases: likely HFT participants pullback to a greater extent than their slower counterparts

Minimum depth remaining† into various data releases broken out by reaction speed of various participants; %



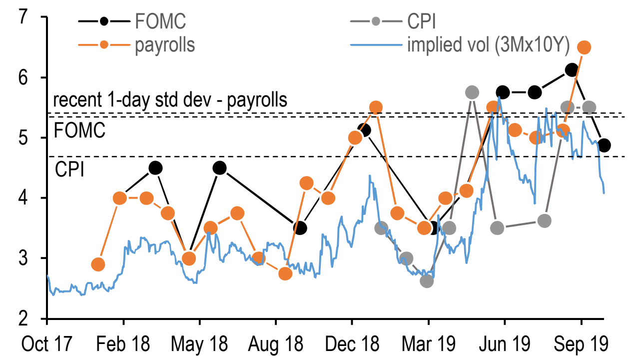
* See Exhibit 1notes for reaction speed breakout definition

† Market depth remaining defined as the minimum observed level of depth into the data release as a percentage of the average depth from 30 minutes to 15 minutes before the data release into, for example going from $200mn to $20mn implies just 10% remaining.

Source: J.P. Morgan, BrokerTec

Exhibit 8: FOMC and payroll date breakevens tend to enjoy a vol premium over surrounding days, whereas CPI trades roughly in line—both trends consistent with recent realized moves

One-day breakevens* (dots) compared to daily implied vol (blue line) and realized day-on-day moves* in 10-year rates (dashed lines); bp



* One day breakevens taken from 24-hour expiry swaptions struck at 11 am the day before data releases (or 11am the day of FOMC meetings) and computed as swaption premium divided by swap DV01. Realized day-on-day moves taken from yield change in traded hot-run Teasuries from 11 am the day before data releases to 11am the day-of (except FOMC which is taken from 3:30pm to 3:30pm). As averaged from 2017-present. To provide a roughly apples-to-apples comparison we scale this move in Treasury yields by the realized 3-month beta of moves in 10-year swap and Treasury yields.

Source: J.P. Morgan

Turning away from microstructure and towards broader market observables, **we find data release days continue to enjoy an elevated risk premium compared with surrounding calendar dates, as measured by one-day option breakevens for both FOMC dates and payrolls** (**Exhibit 6**). These structures tend to price 1-1.5bp richer than the broader vol surface, with the more elevated premiums coming in shorter tails. This premium is well supported by realized rate moves on data-release days, when we find realized vol is commensurately higher than on surrounding days. In contrast, CPI breakevens tend to be roughly in line with broader implieds, consistent with recent historical realized moves.

What conclusions can we draw from this exercise? A central question we've repeatedly posed is: **How resilient will rates market liquidity be in a repeat crisis or other period of elevated stress?** Eleven years ago, algorithmic activity—slower and a bit less dominant than today's technology—largely disappeared from the order book for an extended period of time. Since then we have seen hints that the degree of resiliency among these participants remains in doubt: market depth and HFT market share mostly remain inversely correlated with implied vols, as evidence in large events like the taper tantrum and more subtle regime shifts like the past few months (see Interest Rate Derivatives, *U.S. Fixed Income Weekly*, 10/25/19). **The dynamics highlighted in this note likewise suggest that when the market is prone to severe price wings, algorithmic activity continues to drop off disproportionately**, enhancing and amplifying bouts of elevated volatility.

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