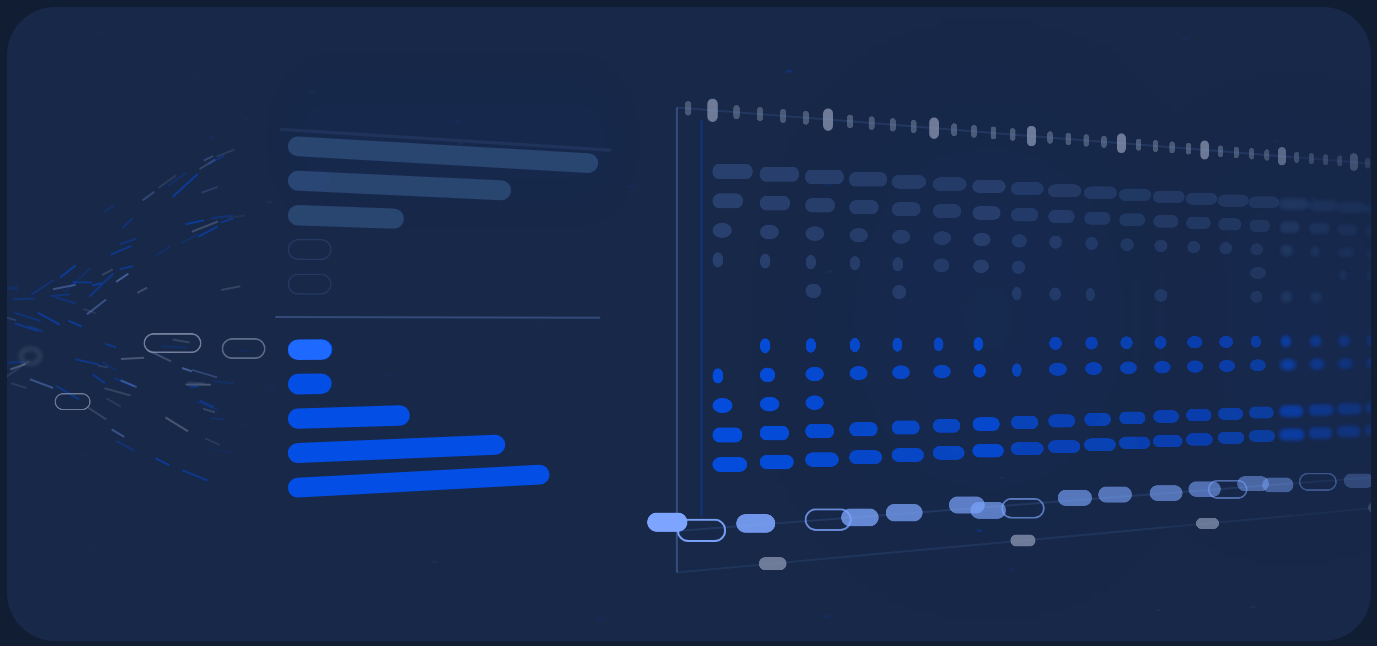
Rillor

METHODS NOTE

Measuring bid-ask spreads from trades and quotes

Effective spread vs realized spread: one measures a trade against the quote midpoint at arrival, the other against a later midpoint. Both need trades matched to quotes and signed.



14 November 2026 Market data rillor.com/insights/measuring-bid-ask-spreads rillor.com

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Summary

Quoted, effective and realized spreads answer different questions, and the last two depend on data steps their formulas leave out.

- SEC Rule 605 defines the average effective spread as double the difference between the execution price and the midpoint of the national best bid and national best offer (NBBO) at order receipt, and the average realized spread as the same difference from the midpoint at a set interval after execution [1, 2].
- Effective spread minus realized spread is price impact, which the SEC reads as a measure of adverse selection. The SEC also states that realized spreads do not measure the actual trading profits of liquidity providers [1].
- Realized spreads depend on the horizon. Amended Rule 605 reports them at 50 milliseconds, 1 second, 15 seconds, 1 minute and 5 minutes, and an SEC analysis of 2023 data found them tending to fall as the horizon lengthened [1, 3].
- Public trade and quote records carry no order receipt time and no trade side, so researchers match trades to quotes and infer direction. In a 2008 sample, NYSE trade and quote (TAQ) files stamped to the second gave percent effective spreads 54% larger than files stamped to the millisecond [4].
- In a Bank of England staff working paper on 2011 Nasdaq data, traditional trade-signing algorithms classified about 98% of volume correctly at nanosecond timestamps and about 90% at second timestamps [5].
- Estimators from daily prices avoid quote matching and carry biases of their own. In Rillor's own study of an on-chain WTI crude perpetual, Roll's estimator overstated the spread measured from the venue's own trade tape by about two times [6].
- The NBBO is built from round-lot quotes, and round lots have scaled with share price since 3 November 2025, so a spread series for stocks above $250 that crosses that date mixes two definitions of the best quote [2, 7].

Background

What a spread measures. Bessembinder and Venkataraman write that execution costs "can be estimated based on comparisons of trade prices to proxies for underlying security value", and that the most common proxy is the quote midpoint [8]. The effective spread compares a trade with midpoints at or before the trade, and the realized spread with midpoints after it [8]. The quoted spread "measures the cost of completing a round trip (buy and sell), if trades are executed at the quoted prices" [8]. Trades also happen at other prices: inside the quotes through price improvement or hidden size, and outside them when a large order walks up the book [8]. Ardia, Guidotti and Kroencke cite studies finding that the quoted spread overestimates the effective spreads traders pay by up to 100%, because dealers offer better prices than the quotes [9].

Rule 605 and its dates. The SEC adopted the rule in November 2000 as Rule 11Ac1-5 [8, 10]. That version defined time of order receipt "to the second" and measured realized spread against the midpoint five minutes after execution [10]. Bessembinder and Venkataraman date monthly reports of effective and realized spreads from September 2001 [8]. On 6 March 2024, the SEC amended the rule to "require that the time of order receipt and time of order execution be measured in increments of a millisecond or finer, and that realized spread be calculated at multiple time intervals" [1]. On 30 September 2025, it moved the compliance date "from December 14, 2025, to August 1, 2026" [11, 12]. Reports covering August 2026 were due by the end of September 2026 [11]. Price improvement statistics against the best available displayed price apply from 1 November 2026, and November 2026 reports are due by the end of December 2026 [13].

Order data and trade data. Rule 605 statistics come from orders: the definitions separate buy orders from sell orders and time them from receipt or execution [2]. The SEC staff calls receipt time "an essential element in calculating many of Rule 605's statistics, such as assigning quotes as benchmarks for effective spread" [13]. Public databases such as TAQ "do not provide information on underlying buy and sell orders", so direction "must be imperfectly inferred", and the choice of value estimates before and after a trade "can significantly affect estimates of trade execution costs" [8].

Conventions. Rule 605 and Holden and Jacobsen use the full spread, twice the signed distance between price and midpoint [2, 4]. Bessembinder and Venkataraman write half-spreads in percent [8], and Odegaard's lecture notes give buyer-initiated trades a sign of -1 [14]. This note uses the full spread, with a sign D of +1 for buys and -1 for sells. It describes measurement only and gives no trading or execution advice.

Method

What was examined. The spread definitions in Rule 605 and in research, and the data steps that computing them from public records requires, from the benchmark quote to the round lot behind it.

Sources. SEC releases, the rule text, the staff FAQ (updated 1 April 2026, one answer modified 8 July 2026) and Holden and Jacobsen's 2014 article are the main sources [1, 2, 4, 13]. Journal articles, a Bank of England staff working paper, two venue documents and Cboe's analysis supply the evidence [5, 7, 9, 15, 16, 17]. Rillor's market data page is cited only for what Rillor holds [18].

How. Definitions are quoted from the rule text in force [2, 3]. The worked example's averages are computed from the SEC staff's inputs and marked "(derived)". IDEAS lists no abstract for Roll (1984) or for Corwin and Schultz (2012), so their methods are described from later papers [9, 19, 20].

Findings

1. Quoted spread

The rule text in force reads: "Average quoted spread means the share-weighted average of the difference between the national best offer and the national best bid at the time of order receipt or, for order executions of midpoint-or-better limit orders, the difference between the national best offer and the national best bid at the time such orders first become executable" [2].

Weighting. Rule 605 weights each order's quoted spread by the shares executed [2, 13]. Holden and Jacobsen compute a stock's quoted spread as a "time-weighted" average [4]. The SEC's 2024 tick size rule also uses a time-weighted figure, the Time Weighted Average Quoted Spread, in which each unique NBB and NBO is weighted by how long it prevailed [21]. For quotes at $1.00 or more, a stock whose figure was $0.015 or less gets a $0.005 increment, and others $0.01 [21]. On 11 June 2026, the SEC exempted compliance with that increment "Until the first business day of November 2027" [22].

The NBBO file. NYSE's Daily TAQ NBBO file "is a record of all quotes that cause the NBBO to change". It credits the exchange with the largest quoted size when several share the best price, and it "does not allow you to determine the total number of round lots across all exchanges at the best price" [23].

Locked and crossed quotes. The NBBO is locked when the best bid equals the best offer [13]. The SEC staff says a locked NBBO "still should be used for all purposes under the Rule" [13]. A crossed NBBO is replaced by the next uncrossed one when less than 30 seconds separate the last uncrossed NBBO from the next, and otherwise the order is excluded [13]. Holden and Jacobsen delete quotes and trades "whenever the NBBO is crossed or locked", because in theory the offer must exceed the bid [4]. A locked quote has a quoted spread of zero, so the two rules give different averages from the same quotes. In their comparison, second-stamped Monthly TAQ gave a negative percent quoted spread 37 times more often than Daily TAQ [4].

2. Effective spread

The rule text in force reads: "Average effective spread means the share-weighted average of effective spreads for order executions calculated, for buy orders, as double the amount of difference between the execution price and the midpoint of the national best bid and national best offer at the time of order receipt and, for sell orders, as double the amount of difference between the midpoint of the national best bid and national best offer at the time of order receipt and the execution price" [2]. Midpoint-or-better limit orders are measured from the time they first become executable [2].

In one line, an execution's effective spread is 2D(P - M), with P the execution price and M the midpoint at receipt. Holden and Jacobsen's dollar effective spread has the same form, with M the midpoint matched to the trade [4].

Percentages. "Average percentage effective spread means the average effective spread for order executions divided by the average midpoint for order executions" [2]. A $250 stock and a $2.50 stock with the same average effective spread have average percentage effective spreads of "0.004% and 0.4%, respectively" [1].

A worked example. In the SEC staff's example, a market order to buy 3,000 shares arrives at 3:30:00.000 p.m. with the NBBO at $25.30 bid and $25.60 offer, a midpoint of $25.45, and fills in three parts [13].

Execution	Shares	Price	Effective spread
1	400	$25.50	$0.10
2	1,000	$25.55	$0.20
3	1,600	$25.60	$0.30
Share-weighted average	3,000		$0.24 (derived)

Source: SEC staff FAQ, Example 27-1 [13].

Each part's spread is its price minus $25.45, "multiplied by 2" [13]. Against the $0.30 quoted spread, the effective spread is 80% of the quoted spread (derived), and divided by the midpoint it is about 0.94% (derived) [2, 13].

Effective over quoted. "An E/Q of 100% means a buy order was executed at the national best offer or a sell order was executed at the national best bid, and an E/Q of 0% means an order was executed at the midpoint of the NBBO" [1]. The adopted statistic "is equivalent to the average effective spread divided by the average quoted spread, expressed as a percentage" [1].

Orders and weights. Rule 605 reports these statistics for market orders, marketable limit orders and the other marketable and midpoint-or-better types it lists, and "does not require quoted spread, effective spread, price improvement/disimprovement, and size improvement statistics for non-marketable limit orders" [1, 13]. Its weights are "based on the number of shares executed" [13], while Holden and Jacobsen weight by dollar volume [4]. Two studies of the same executions can differ by weighting alone.

Bias from the midpoint. Hagströmer finds that the effective spread measured from the midpoint "overstates the true effective bid-ask spread in markets with discrete prices and elastic liquidity demand" [24]. The average bias is 13% to 18% for S&P 500 stocks, depending on the benchmark estimator, and up to 97% for low-priced stocks, and the paper proposes new estimators [24].

3. Realized spread and price impact

The rule text in force reads: "Average realized spread means the share-weighted average of realized spreads for order executions calculated, for buy orders, as double the amount of difference between the execution price and the midpoint of the national best bid and national best offer at a specified interval after the time of order execution" [2]. Sell orders mirror it, and the final NBBO of regular trading hours is used when it comes less than the interval after execution [2]. For a horizon that falls inside a trading halt, the staff uses "the last NBBO disseminated prior to the time of the trading halt" [13].

Five horizons. The rule lists "the average realized spread as calculated 50 milliseconds after the time of execution", then 1 second, 15 seconds, 1 minute and 5 minutes, each with a percentage version [1, 3]. The SEC proposed 15 seconds and 1 minute, then added 50 milliseconds and 1 second and kept 5 minutes [1].

The decomposition. With M the midpoint at the trade and M' the midpoint a horizon later:

Measure	Full-spread formula	Sources
Effective spread	2D(P - M)	[1, 4]
Realized spread	2D(P - M')	[1, 4]
Price impact	2D(M' - M)	[1, 4]

The SEC derives realized spread as effective spread minus price impact, and Holden and Jacobsen's equations give the same identity with M' five minutes later [1, 4].

Effective spread vs realized spread in Rule 605 reports. The SEC states that the decomposition in Rule 605 reports is not exact, because the effective spread uses the midpoint at order receipt and the realized spread is measured from execution [1]. The gap grows with the time between the two, and non-marketable limit orders (NMLOs) wait longer: "37.5% of marketable limit orders are executed within 10 milliseconds after order receipt, while only 7.2% of at-the-quote NMLOs are executed within 10 milliseconds" [1]. In studies built from trade records, both measures start from the trade's own time and quote, so the identity holds by construction [4].

What realized spread means. The SEC writes that "price impact can be thought of as a measure of adverse selection", and that realized spreads "can thus be thought of as the portion of the spread that liquidity providers earn in excess of adverse selection" [1]. It adds that "smaller (or even negative) realized spreads reflect that liquidity providers are earning less of the spread" [1]. It also sets a limit: "Realized spreads do not measure the actual trading profits that liquidity providers earn from supplying liquidity" [1]. Providers offset positions at other prices and times, hold them for different periods, and "realized spread metrics do not take into account any transaction rebates or fees, including PFOF", payment for order flow [1].

4. Choosing the benchmark quote and horizon

The quote before the trade. The rule text in force reads: "Time of order receipt means the time (at a minimum to the millisecond) that an order was received by a market center for execution", or by a broker or dealer that is not acting as a market center [2]. Rule 605 benchmarks at receipt, when orders "first are captured in an automated order handling system" [13]. When an order arrives in the same millisecond as one or more quote changes, a reporter in milliseconds uses "the NBBO that was in effect at the start of that millisecond" [13].

Trade records show only the trade time. Bessembinder and Venkataraman report that "prices move systematically and adversely in the seconds before even small trades are executed" [8]. As they describe it, Bessembinder (2003) "recommends that researchers use quotation midpoints in effect five seconds prior to the trade report time" [8]. For Daily TAQ, Holden and Jacobsen match each trade to "the NBBO that was in-force one millisecond earlier", and found the difference from a 100-millisecond lag "very small" [4].

The quote after the trade. In Bessembinder and Venkataraman's account, with a short horizon "temporary price effects may still dominate", and a long one adds noise from unrelated news [8]. "In the absence of theoretical guidance", studies have used the close, the volume-weighted average price, trade prices 5 and 30 minutes later, and midpoints 30 minutes and 24 hours later [8].

Later evidence finds the horizon matters. The SEC states that "Realized spreads vary significantly with the chosen time horizon" [1]. Its analysis used TAQ data from the first quarter of 2023 for 400 stocks in four groups by market value, from under $100 million to over $10 billion, at horizons from 10 milliseconds to five minutes [1]. Realized spreads "tend to decrease as the time horizon increases", except at five minutes for the group over $10 billion [1].

Conrad and Wahal studied every trade in all common stocks from 2010 to 2017 [15]. "The term structure of realized spreads (price impact) is sharply downward (upward) sloping", so the horizon "is critical when drawing inferences from spread decompositions" [15]. Most of the price impact took place within 15 seconds in large stocks and 60 seconds in small ones [15]. At a 100-millisecond horizon, aggregate profits fell from 1.9 basis points of total dollar volume in 2010 to 1.0 in 2017 [15].

5. Signing trades: Lee-Ready and later methods

The rules. Lee and Ready documented two problems with quote-based classification: "quotes may be recorded ahead of trades that triggered them, and trades inside the spread are not readily classifiable" [25]. Holden and Jacobsen state three conventions [4]:

Rule	Buy	Sell	Otherwise
Lee and Ready	Above the midpoint	Below the midpoint	Tick test

Rule	Buy	Sell	Otherwise
Ellis, Michaely and O'Hara	At the ask	At the bid	Tick test
Chakrabarty and coauthors	Top 30% of the spread	Bottom 30%	Tick test

Source: [4].

The tick test "specifies that a trade is a buy (sell) if the most recent prior trade at a different price was at a lower (higher) price" [4]. When the market is locked or crossed, Holden and Jacobsen use the tick test alone [4]. Lee and Ready recommended moving early-1990s NYSE timestamps by five seconds for reporting lags, and studies of later data found the allowance unnecessary [8].

How often they are right. On a Nasdaq data set that identifies trade direction, Ellis, Michaely and O'Hara found that the quote rule, the tick rule and the Lee and Ready rule classified 76.4%, 77.66% and 81.05% of trades correctly [26]. All three had "only a very limited success in classifying trades executed inside the quotes", and the algorithms did "a mediocre job when used for calculating effective spreads" [26]. Bessembinder and Venkataraman report that prior research on order-level data puts Lee and Ready at about 85% correct [8]. Jurkatis cites two recent studies at about 85% and 79%, and microsecond London Stock Exchange data from 2017 with "only 46% accuracy" [5].

His own sample holds over 134 million Nasdaq transactions from May to July 2011, stamped to the nanosecond, with the true liquidity-demanding side known [5]. He truncated the timestamps to simulate coarser data [5].

Timestamp precision	Traditional algorithms	Jurkatis's FI algorithm
Nanoseconds	About 98% of volume	About 98% of volume
Seconds	About 90% of volume	95% of volume

Source: [5].

The FI algorithm "actively searches for the quote that matches a trade" [27]. At second timestamps it halves misclassified shares [5]. Interpolating timestamps "considerably decreases the classification accuracy" of the traditional algorithms, compared with the last quote before the original timestamp [5].

Bulk volume classification. Easley, López de Prado and O'Hara developed bulk volume classification (BVC), which they argue is more useful in high-frequency markets than standard procedures [28]. Chakrabarty, Pascual and Shkilko found that the tick rule and Lee and Ready "produce significantly better classifications than the BVC" [29].

Feeds that report the side. CME's MDP 3.0 trade summary has tag 5797 AggressorSide, which "Indicates which side is the aggressor or if there is no aggressor", with 1 for bid aggressor and 2 for ask aggressor [16]. Coinbase's match messages name the maker: "The side field indicates the maker order side", and a match with a sell side counts as an up-tick [17]. The trade's sign there is the opposite of its side field. Under 2D(P - M), a trade signed the wrong way enters the effective spread with its sign reversed, so a side field needs its definition read first [4, 17].

6. Timestamp precision and quote matching

TAQ timestamps. Daily TAQ moved from seconds in January 1993 to milliseconds in October 2003, and to nanoseconds on 24 October 2016 for Nasdaq-listed stocks (UTP) and 18 September 2017 for NYSE and other listings (CTA) [23]. Exchange clocks are synchronized to within "100 microseconds or less" [23].

Quote timing rules for second stamps. "Prior Second" matches a trade to the NBBO in force in the prior second and "Same Second" to the NBBO during the same second. Holden and Jacobsen's "Interpolated Time" "uses the ordering of trades and quotes within a second to make an educated guess about the millisecond" [4]. Of the 28 articles they found in three journals from 2006 to 2011 that used Monthly TAQ, seven used Prior Second, three Same Second and five the quote five seconds earlier, and the rest gave no quote timing [4].

What second stamps do to spreads. Holden and Jacobsen compared Monthly TAQ, stamped to the second, with Daily TAQ, stamped to the millisecond, for 100 randomly selected stocks from 1 April to 30 June 2008, with "34 million trades and 351 million quotes" [4].

Measure	Monthly TAQ against Daily TAQ
Percent effective spread	54% larger
Percent quoted spread	47% smaller
Effective spread above quoted spread	15% more often
Trades outside the NBBO	26.3% of trades against 3.3%, eight times as often
Percent realized spread	12% larger
Percent price impact	109% larger

Source: [4].

The causes were withdrawn quotes, second versus millisecond timestamps, and others including canceled quotes [4]. Their three fixes for Monthly TAQ removed the quoted spread difference and cut "the percent effective spread difference ... by 91%" [4]. With withdrawn quotes accounted for (26.3% with no adjustments), trades outside the NBBO fell from 17.6% under Prior Second to 13.7% under Interpolated Time and 5.6% with crossed and locked states also excluded, against 3.3% in Daily TAQ [4]. The authors conclude that "These solutions change research inferences" [4].

Quotes per second. In Jurkatis's Nasdaq sample, there was "a median of 17 quote changes per second in which at least one trade occurs" [5].

7. Estimators from low-frequency data

Ardia, Guidotti and Kroencke state the need: computing the effective spread directly requires matched high-frequency trades and quotes, which are "typically not available for international markets, asset classes other than stocks, and time periods prior to 1993" [9].

Roll's estimator. Their model assumes a constant spread over the window, observed buy prices above actual prices by half the spread and sell prices below, buys and sells equally likely, and uncorrelated actual returns [9]. With closing prices, the covariance of successive price changes equals $-(S^2/4)(1 - \nu)^2$, with S the spread and ν the share of periods with an unchanged close [9]. When ν is 0, "the C estimator is identical to the bid-ask estimator of Roll (1984)" [9, 19]. The spread is then twice the square root of minus that covariance (derived) [9].

Where daily estimators fail. The squared estimate "may become negative in finite samples", and the studies the authors cite find that setting negatives to zero overstates monthly spreads from daily data where the true spread is 0.50% or smaller [9]. In their simulation, with a constant 1% spread, a 10% trade probability and about 39 trades a day, Roll's estimator returns zero "about 40% of the times" even with one year of daily data [9]. The Abdi and Ranaldo and the Corwin and Schultz estimators gave non-positive estimates 20% to 30% of the time with a one-year window, and the authors' EDGE estimator under 5% [9]. The Roll, Corwin and Schultz, and Abdi and Ranaldo estimators "lead to biased results when trading is infrequent" [9].

Other daily estimators. Corwin and Schultz estimate spreads "from daily high and low prices" [20]. Abdi and Ranaldo use close, high and low prices "when quote data are not available", and report that it generally provides the highest correlations with the TAQ effective spread benchmark [30]. Hasbrouck's Gibbs estimate from daily closing prices "achieves a correlation of 0.965 with the transaction-level estimate" in a validation sample [31]. In Goyenko, Holden and Trzcinka's "horseraces" against TAQ and Rule 605 benchmarks, "the new effective/realized spread measures win the majority" [32]. Ardia, Guidotti and Kroencke tested EDGE on about 1.6 million stock-month estimates from 1993 to 2020 and call it "on average, twice as accurate as the best-performing estimators available today", the authors' own claim [9].

One comparison against a trade tape. Rillor's own study measured the spread on Lighter's WTI perpetual at 0.8 to 1.3 basis points per side from the venue's own trade tape [6]. "Roll's estimator overstated it by about two times, and a comparable figure from another venue's top-of-book feed understated it by about three

times" [6]. It concludes that "Cost estimates need the venue's own data" [6].

8. Round lots and odd lots in the quote

The NBBO counts round lots. Rule 600 defines a bid or offer as a price "at which it is willing to buy or sell one or more round lots of an NMS security" [2]. The NBBO behind quoted, effective and realized spreads is built from round-lot quotes [2].

The 3 November 2025 change. Since that date, round lot sizes are scaled to share price: 100 shares for stocks at or below $250, 40 shares from $250 to $1,000, 10 shares from $1,000 to $10,000 and one share above $10,000 [7]. Cboe's own analysis of securities information processor (SIP) data shows the break, in basis points (bps) [7].

Price group	Average NBBO spread before	After
$0 to $250	About 80 bps	About 85 bps
$1,000 to $10,000	About 53 bps, July to October 2025	About 35 bps, November 2025 to March 2026
Above $10,000	9 bps	10 bps

Source: Cboe [7].

In the $1,000 to $10,000 group, inside size fell "from approximately 99 shares in October to around 32 shares in November, a 68% decrease" [7]. A change in the NBBO changes the midpoint that effective and realized spreads start from, which is why the SEC said in 2024 that its horizon results for stocks over $250 may differ under the Market Data Infrastructure Rules, though it did not expect the relative variation across horizons to change (Finding 4) [1, 2].

Odd lots. When O'Hara, Yao and Ye wrote, odd lots "are not reported to the consolidated tape or in databases such as TAQ" [33]. In their sample, the median odd-lot share of trades was 24%, some stocks had 60% or more, odd lots contributed 35% of price discovery, and omitting them "leads to inaccuracies in order imbalance measures" [33]. NYSE's current Daily TAQ specification carries odd-lot trades (sale condition I) and an odd-lot quotes file [23].

The best available displayed price. For a buy order, amended Rule 605 defines it as "the lower of: the national best offer at the time of order receipt or the price of the best odd-lot order to sell at the time of order receipt", and the mirror for sells [2]. Price improvement against it is reported from 1 November 2026 [13]. Effective and realized spreads keep the NBBO midpoint [2].

Implications

For researchers. A spread study can state each choice below, since the sources show several of them moving the result [1, 4, 15].

Choice	Options in the sources	Sources
Convention	Full spread, or half-spread in percent	[2, 8]
Quote before the trade	Midpoint at receipt, one millisecond earlier, or five seconds earlier	[2, 4, 8]
Horizon after the trade	50 milliseconds to 5 minutes, or the close and longer	[3, 8]
Trade sign	Lee and Ready, Ellis, Michaely and O'Hara, Chakrabarty and coauthors, FI, or a side field	[4, 16, 27]
Quote timing at second stamps	Prior Second, Same Second or Interpolated Time	[4]
Locked and crossed quotes	Kept, or deleted	[4, 13]
Weighting	Shares executed, dollar volume, or time	[4, 13, 21]
Round lot regime	Before or after 3 November 2025	[7]

Report realized spreads at more than one horizon, since their term structure slopes sharply [15], and do not read them as a liquidity provider's profit [1]. Before relying on a daily estimator, a check against trade records for a sample period shows the size of its error [6, 9].

For transaction-cost analysts. Rule 605 reports from August 2026 give realized spreads at five horizons from order data, which differ from trade-based statistics in benchmark time, trade sign and weighting [1, 2, 8, 11].

For data engineers. Keep each source's timestamps as published, with their precision, since the quote a trade meets depends on them [4, 23]. Read each feed's side field by its own definition [16, 17], and flag 3 November 2025 in quote series for stocks above $250 [7]. Rillor's market data holds U.S. stock and futures trade and quote history from 2018, mapped to one symbol list, and every trade and quote sits on the same UTC clock as the on-chain order books, with the source's own timestamp kept beside capture time [18].

Limits of this analysis

- No trade or quote data was analyzed.
- The trade-signing accuracy figures here end with Jurkatis's 2011 Nasdaq sample and the 2017 London data he cites. No source measures Lee and Ready on 2025 or 2026 U.S. data.
- The SEC's horizon analysis is reported by direction only, and no aggregate of the amended Rule 605 reports was available.
- Rillor's crude study measured the spread of one instrument on one venue [6].
- Regulatory status is as of 13 November 2026.

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