

Summary of Market Data Revenue Allocation Formula

Overview

Regulation NMS changed the formula for determining how market data income (revenue less administrative expenses) is allocated to individual SRO participants (“Revenue Allocation Rule”). The Revenue Allocation Rule sets forth a two-step process to allocate Plan revenue among CTA and UTP Plan Participants.

- The first step is to identify the revenue attributable to each Eligible Security in the Network’s data stream (the “Security Income Allocation” or “SIA”).
- The second step is to identify the Participant’s share of revenue in an Eligible Security based on the “Trading Share” and “Quoting Share” of each Participant. 50% of the SIA is allocated to Participants based on their respective Trading Share and 50% of the SIA is allocated to the Participants based on their respective Quoting Share.

A Participant’s Trading Share of an Eligible Security is determined by the Participant’s portion of qualified trades in a security by dollar volume.

A Participant’s Quoting Share of an Eligible Security is based on the “Quote Rating,” which is the fraction of total Quote Credits earned by each Participant. A Quote Credit is the product of three factors: the price of the best bid or offer, the duration of the quotation, and the number of shares in the quotation.

Following adoption of Regulation NMS, the Securities Information Processors (SIPs) formed a task group to implement the Revenue Allocation Rule. The task group, composed of CTA and UTP Plan Participants, with assistance from industry consultants and concurrence from Commission staff, drafted a document entitled *CTA/UTP Revenue Allocation Functional Requirements Specification* (“Specifications document”) to specify how the new Revenue Allocation Rule would be implemented in production.¹

The following outlines the three key parts of the allocation process.²

Part 1: Security Income Allocation (SIA) Process

The first step of the process is to compute the income allocation for each security (over 8,000 securities) based on the square root of that security’s dollar value traded divided by the sum of the square roots of all securities’ traded dollar values.

As an illustration, in 2016, the top 200 of 9,390 securities accounted for 52.8% of the total dollar value traded, but after applying the square root function, these securities accounted for 19.9% of the market data income. Less active securities receive a higher income allocation due to the square root function. To prevent allocating too much income to issues that rarely trade, the SIA for a security is capped at \$4

¹ Tee Williams Associates, Inc., *CTA/UTP Revenue Allocation Functional Requirements Specification*, Version 1.9 (“Specifications document”) (March 21, 2006).

² Any summary necessarily omits certain details of the revenue allocation process to facilitate a clear description. In the event of any inadvertent disparity between this outline and the Specifications Document, the information in the Specifications Document will govern.

per transaction report (see below). Any income above \$4 per transaction is distributed to the remaining symbols that did not exceed the \$4 cap.

Table 1: Dollar Volume Traded by Security Group in 2016

Securities Ranked by Dollar Volume Traded	Average Daily Dollar Volume Traded (\$ bn)	% of Dollar Volume Traded	% of Income Allocation
Top 200	\$145.0	52.8%	19.9%
201-500	\$51.3	18.7%	14.4%
501-1000	\$37.9	13.8%	16.2%
Over 1000 (8,380 securities)	\$40.5	14.7%	49.5%

Source: Consolidated tape

Part 2: Trading Share Process (50% of Income Allocation)

The SIP collects trade reports from all SROs, including off-exchange venues reporting trades via the FINRA TRFs. Trades that are reported by a Participant to the SIP on a bundled basis are unbundled by the SIPs based on end-of-day trade reports provided by a Participant to the SIPs. Transaction reports with \$5,000 volume or more get one credit and smaller trades of less than \$5,000 get a fraction of credit.

Example: The Security Income Allocation for Security A is \$435.78, so the total trade revenue is \$217.89 (50% of \$435.78). Table 2 illustrates how the \$217.89 is allocated among three SROs based on the dollar value traded formula. The \$600 trade by SRO2 receives a fraction of a credit of 0.12 (\$600/\$5000). This trade accounts for 2.0% of the total dollar volume traded (\$600/\$30,600) and 5.7% of the percentage of qualified transaction reports (0.12/2.12), which results in a trade allocation revenue of **\$8.30**, which is 3.8% [(2.0%+5.7%)/2] of \$217.89.

$$\text{SRO2 trade revenue allocation} = 50\% \times \$435.78 \times [(2.0\%+5.7\%)/2] = \mathbf{\$8.38}$$

Table 2: Trade Share Calculation for Security A with Total Trade Revenue of \$217.89

SRO	Share Size	Stock Price	Dollar Volume (DV)	% of Dollar Value Trade (DV%)	Qualified Transaction Report (QTR)*	QTR %	Trade Rating (Average of DV% & QTR%)	Trade Share (Trade Rating X \$217.89)	% of Trade Share
SRO1	4,000	\$2.5	\$10,000	32.7%	1.0	47.2%	0.40	\$86.99	39.9%
SRO2	300	\$2.0	\$600	2.0%	0.12	5.7%	0.04	\$8.30	3.8%
SRO3	10,000	\$2.0	\$20,000	65.4%	1.0	47.2%	0.56	\$122.60	56.3%
Total	14,300		\$30,600	100%	2.12	100%		\$217.89	100%

* Transaction reports of \$5,000+ value get 1 credit and smaller trades of less than \$5,000 get a fraction of a credit by dividing the trade amount by \$5,000.

Source: Consolidated tape

Part 3: Quoting Share Process (50% of Income Allocation)

The Quoting Share is based on the duration and dollar size of automated quotes at the best prices of each Participant, independently for the best bids and best offers, and adjusted as described below. If multiple Participants share the best price, then each Participant will receive Quote Credit for its quoted size. Quote Credit is the three-way product of the price of the bid (offer), multiplied by the time period a Participant's bid (offer) is at the best bid (offer), and then further multiplied by its size.

Basic Example of Earning Quote Credits:

- The Security Income Allocation for a Security A is \$435.78, so the total quote revenue is **\$217.89** (50% of \$435.78).
- SRO1 earns Quote Credit in Security A of **59,000** as follows: SRO1 quotes for 59 seconds at the best bid of \$10 for 100 shares. $59,000 = 59 \text{ seconds} \times \$10 \times 100 \text{ shares}$.
- The total Quote Credits earned in Security A across all markets is **550,000**.
- In Security A, SRO1 is allocated quote income of **\$23.37**, which is 10.7% ($59,000/550,000$) of total quote income of \$217.89.

Multiple Quotes:

Quote credits are calculated by a Participant only if its bid (offer) persists as the best bid (offer) of that Participant for a Minimum Credit Interval (currently set to one second), although multiple, sequential bids (offers), with changed price or size, from a single Participant may be concatenated to satisfy this condition. If the Participant's bid(s) (offer(s)) remains the best bid (offer) of that Participant for longer than the Minimum Credit Interval, credit is earned for the longer period.

In cases where a Participant displays quotes that are not consistently at the same price for a second, simply discarding prices that do not last for one full second creates an undesirable effect.³ To remedy this situation, Quote Credits are earned by calculating each Participant's lowest bid/highest offer within each 1/10th of a one-second time period, i.e., "Worst Price," and calculating the Revenue Best Bid & Offer (RBBO) among all Adjusted Prices, as described below.

The steps for calculating quote credit are as follows. The example is for a bid quote.

Step 1: Calculate Worst Price and Worst Size

For each Participant, identify the Worst Price for each 1/10th of a second time period. Then select the smallest quote among Worst Priced quotes. This is the "Worst Size." All remaining quotes in that fixed time period are discarded.

Example: During the fixed 1/10th of a one-second time period of 9:30:00.3 to 9:30:00.4, the Worst Price is **\$50.10** and the Worst Size is **100** shares.

³ Discarding all sub-second spread narrowing quotes might unduly reward less aggressive quoting and/or create gaming opportunities for market participants to disrupt longer-duration, continuous quoting to prevent revenue credits.

Exchange A, Symbol 'ABC'				
End Time	Bid Price	Bid Size	Worst Price	Worst Size
9:29:59.8	\$ 50.10	100	\$ -	
9:29:59.9	\$ 50.10	100	\$ -	
9:30:00.0	\$ 50.10	100	\$ 50.10	100
9:30:00.1	\$ 50.10	100	\$ 50.08	400
9:30:00.2	\$ 50.08	200	\$ 50.10	200
9:30:00.3	\$ 50.10	200	\$ 50.10	100
9:30:00.3	\$ 50.10	100	\$ 50.10	100
9:30:00.3	\$ 50.11	300		
9:30:00.4	\$ 50.11	300	\$ 50.11	300
9:30:00.5	\$ 50.10	200	\$ 50.10	200
9:30:00.6	\$ 50.10	200	\$ 50.10	200
9:30:00.7	\$ 50.10	200	\$ 50.10	200
9:30:00.8	\$ 50.10	200	\$ 50.10	200
9:30:00.9	\$ 50.08	100	\$ 50.08	100
9:30:01.0	\$ 50.11	300	\$ 50.11	300
9:30:01.1	\$ 50.09	200	\$ 50.09	200
9:30:01.2	\$ 50.09	200	\$ 50.09	200
9:30:01.3	\$ 50.09	200	\$ 50.09	200
9:30:01.4	\$ 50.09	200	\$ 50.09	200

Prior to Market Open = Ineligible for quote credit

Market Open

When multiple quotes comes in from the same Market within the same 1/10th of a second interval, the lowest price is selected for the "Worst Price"

When multiple quotes come in from the same Market within the same 1/10th of a second interval, the quote with the "Worst Size" at the "Worst Price" is selected

Step 2: Minimum Ahead

Select the least aggressive price of all Worst Prices over the next one-second period. This is the "Minimum Ahead" value.

Example: During the one-second time period between 9:30:00.0 and 9:30:00.9, **\$50.08** is the minimum ahead of the ten Worst Prices in each 1/10th of a second period. (Note that the Worst Price values presented after 9:30:00.5 do not affect the Minimum Ahead value.)

Exchange A, Symbol ABC		
End Time	Worst Price	MIN Ahead
9:29:59.8	\$ -	
9:29:59.9	\$ -	
9:30:00.0	\$ 50.10	\$ 50.08
9:30:00.1	\$ 50.08	\$ 50.08
9:30:00.2	\$ 50.10	\$ 50.08
9:30:00.3	\$ 50.10	\$ 50.08
9:30:00.4	\$ 50.11	\$ 50.08
9:30:00.5	\$ 50.10	\$ 50.08
9:30:00.6	\$ 50.10	\$ 50.08
9:30:00.7	\$ 50.10	\$ 50.08
9:30:00.8	\$ 50.10	\$ 50.08
9:30:00.9	\$ 50.08	\$ 50.08
9:30:01.0	\$ 50.11	\$ 50.09
9:30:01.1	\$ 50.09	\$ 50.09
9:30:01.2	\$ 50.09	\$ 50.09
9:30:01.3	\$ 50.09	\$ 50.08
9:30:01.4	\$ 50.09	\$ 50.08

Prior to Market Open = Ineligible for quote credit

Step 3: Adjusted Price

To address multiple quotes at different prices, all Quote Credits are calculated using Adjusted Prices. The goal is to find which of the ten possible one-second minimum credit intervals around a given 1/10th of a second has the highest minimum price (which will be used in the next step to construct the narrowest possible RBBO). The logic is as follows: Determine the Adjusted Price as the greatest of the Minimum Ahead values for the current time period and the nine previous periods (i.e., one second).

Example: Starting at 9:30:00:9 (the time the Worst Price of \$50.08), count back ten to 9:30:00.0. During the one-second time period between 9:30:00.0 and 9:30:00.9, the highest “MIN Ahead” price is **\$50.08** of the ten MIN Ahead prices in each 1/10th of a second period.

Exchange A			
End Time	Worst Price	MIN Ahead	Adjusted Price
9:29:59.8	\$ -		
9:29:59.9	\$ -		
9:30:00.0	\$ 50.10	\$ 50.08	\$ 50.08
9:30:00.1	\$ 50.08	\$ 50.08	\$ 50.08
9:30:00.2	\$ 50.10	\$ 50.08	\$ 50.08
9:30:00.3	\$ 50.10	\$ 50.08	\$ 50.08
9:30:00.4	\$ 50.11	\$ 50.08	\$ 50.08
9:30:00.5	\$ 50.10	\$ 50.08	\$ 50.08
9:30:00.6	\$ 50.10	\$ 50.08	\$ 50.08
9:30:00.7	\$ 50.10	\$ 50.08	\$ 50.08
9:30:00.8	\$ 50.10	\$ 50.08	\$ 50.08
9:30:00.9	\$ 50.08	\$ 50.08	\$ 50.08
9:30:01.0	\$ 50.11	\$ 50.09	\$ 50.09
9:30:01.1	\$ 50.09	\$ 50.09	\$ 50.09
9:30:01.2	\$ 50.09	\$ 50.09	\$ 50.09
9:30:01.3	\$ 50.09	\$ 50.08	\$ 50.09
9:30:01.4	\$ 50.09	\$ 50.08	\$ 50.09

Prior to Market Open = Ineligible for quote credit

Step 4: Revenue Best Bid & Offer (RBBO)

The RBBO is the best Adjusted Price among all markets. An eligible automated quote only earns credit if it is at the RBBO for at least the one-second Minimum Credit Interval.

Example: During the fixed 1/10th of a second time period of 9:30:00.0, the highest Adjusted Bid Price among Exchange A and Exchange B is **\$50.08**.

Select the Highest Adjusted Price among all Participants = RBB

Exchange A Quotes (Bid Price/Size)					Exchange B Quotes (Bid Price/Size)				Exchange at RBB for Symbol ABC	
End Time	Worst Price	MIN Ahead	Adjusted Price	RBB	Worst Price	MIN Ahead	Adjusted Price	RBB	RBB	Exchange at RBB for Symbol ABC
9:30:00.0	\$ 50.10	\$ 50.08	\$ 50.08	Yes	\$ 50.06	\$ 50.06	\$ 50.06	No	\$ 50.08	Exchange A
9:30:00.1	\$ 50.08	\$ 50.08	\$ 50.08	Yes	\$ 50.06	\$ 50.06	\$ 50.06	No	\$ 50.08	Exchange A
9:30:00.2	\$ 50.10	\$ 50.08	\$ 50.08	Yes	\$ 50.06	\$ 50.06	\$ 50.06	No	\$ 50.08	Exchange A
9:30:00.3	\$ 50.10	\$ 50.08	\$ 50.08	Yes	\$ 50.06	\$ 50.06	\$ 50.06	No	\$ 50.08	Exchange A
9:30:00.4	\$ 50.11	\$ 50.08	\$ 50.08	Yes	\$ 50.06	\$ 50.06	\$ 50.06	No	\$ 50.08	Exchange A
9:30:00.5	\$ 50.10	\$ 50.08	\$ 50.08	Yes	\$ 50.06	\$ 50.06	\$ 50.06	No	\$ 50.08	Exchange A
9:30:00.6	\$ 50.10	\$ 50.08	\$ 50.08	Yes	\$ 50.06	\$ 50.06	\$ 50.06	No	\$ 50.08	Exchange A
9:30:00.7	\$ 50.10	\$ 50.08	\$ 50.08	Yes	\$ 50.06	\$ 50.06	\$ 50.06	No	\$ 50.08	Exchange A
9:30:00.8	\$ 50.10	\$ 50.08	\$ 50.08	Yes	\$ 50.06	\$ 50.06	\$ 50.06	No	\$ 50.08	Exchange A
9:30:00.9	\$ 50.08	\$ 50.08	\$ 50.08	Yes	\$ 50.06	\$ 50.06	\$ 50.06	No	\$ 50.08	Exchange A
9:30:01.0	\$ 50.11	\$ 50.09	\$ 50.09	Yes	\$ 50.06	\$ 50.06	\$ 50.06	No	\$ 50.09	Exchange A
9:30:01.1	\$ 50.09	\$ 50.09	\$ 50.09	Yes	\$ 50.06	\$ 50.06	\$ 50.06	No	\$ 50.09	Exchange A
9:30:01.2	\$ 50.09	\$ 50.09	\$ 50.09	Yes	\$ 50.06	\$ 50.06	\$ 50.06	No	\$ 50.09	Exchange A
9:30:01.3	\$ 50.09	\$ 50.08	\$ 50.09	No	\$ 50.10	\$ 50.10	\$ 50.10	Yes	\$ 50.10	Exchange B
9:30:01.4	\$ 50.09	\$ 50.08	\$ 50.09	No	\$ 50.10	\$ 50.06	\$ 50.10	Yes	\$ 50.10	Exchange B

Step 5: Minimum Size

Quote credit is apportioned based on the length of time a quote remains at the RBB and the size of that quote.

From the Worst Size column, take the lowest size at the worst adjusted price for the minimum credit interval (i.e., one second) used to calculate quote credit.

Example: During the one-second time period between 9:30:00.0 and 9:30:00.9, the Minimum Size of the ten Revenue Best Bids was **100 shares**.

Exchange A, Symbol ABC						
End Time	Worst Bid Price	MIN Ahead	Adjusted Price	RBB	Worst Size	Min Size
9:30:00.0	\$ 50.10	\$ 50.08	\$ 50.08	Yes	100	100
9:30:00.1	\$ 50.08	\$ 50.08	\$ 50.08	Yes	400	
9:30:00.2	\$ 50.10	\$ 50.08	\$ 50.08	Yes	200	
9:30:00.3	\$ 50.10	\$ 50.08	\$ 50.08	Yes	100	
9:30:00.4	\$ 50.11	\$ 50.08	\$ 50.08	Yes	300	
9:30:00.5	\$ 50.10	\$ 50.08	\$ 50.08	Yes	200	
9:30:00.6	\$ 50.10	\$ 50.08	\$ 50.08	Yes	200	
9:30:00.7	\$ 50.10	\$ 50.08	\$ 50.08	Yes	200	
9:30:00.8	\$ 50.10	\$ 50.08	\$ 50.08	Yes	200	
9:30:00.9	\$ 50.08	\$ 50.08	\$ 50.08	Yes	100	
9:30:01.0	\$ 50.11	\$ 50.09	\$ 50.09	Yes	300	
9:30:01.1	\$ 50.09	\$ 50.09	\$ 50.09	Yes	200	
9:30:01.2	\$ 50.09	\$ 50.09	\$ 50.09	Yes	200	

Size is calculated for quote credit based on a 1 second interval

Step 6: Median Size

From the “Worst Size” column, identify the median size of the ten Revenue Best Bids or ten Revenue Best Offers of the minimum credit interval (i.e., one second) used to calculate quote credit. In the above example, the Median Size is **200 shares**.

Step 7: Adjusted Size

Compare both the “MIN Size” and “Median Size” and take the lesser of the two sizes. In the example, the Adjusted Size is **100 shares**.

Step 8: Calculate Whole Unit Quote Credit

Quote durations are credited in whole units of the minimum credit interval (one-second increments) plus any fragments of the minimum credit interval after the one-second increment has been satisfied. Take the Worst (lowest) Adjusted Price (for the one-second interval) and multiply it by the adjusted size.

Example: During the one second time period between 9:30:00.0 and 9:30:00.9, the Whole Unit Quote Credit is **5,008** (\$50.08 Adjusted Price X 100 shares).

Worst Adjusted Price * Adjusted Size = Whole Unit Credit

Exchange A, Symbol ABC									
	A	B	C	D	E	F	G	H	I
End Time	Worst Bid Price	MIN Ahead	Adjusted Price	RBB	Worst Size	Min Size	Median Size	Adjusted Size	Exchange 'A' Credit
9:30:00.0	\$ 50.10	\$ 50.08	\$ 50.08	Yes	100	100	200	100	5,008
9:30:00.1	\$ 50.08	\$ 50.08	\$ 50.08	Yes	400				
9:30:00.2	\$ 50.10	\$ 50.08	\$ 50.08	Yes	200				
9:30:00.3	\$ 50.10	\$ 50.08	\$ 50.08	Yes	100				
9:30:00.4	\$ 50.11	\$ 50.08	\$ 50.08	Yes	300				
9:30:00.5	\$ 50.10	\$ 50.08	\$ 50.08	Yes	200				
9:30:00.6	\$ 50.10	\$ 50.08	\$ 50.08	Yes	200				
9:30:00.7	\$ 50.10	\$ 50.08	\$ 50.08	Yes	200				
9:30:00.8	\$ 50.10	\$ 50.08	\$ 50.08	Yes	200				
9:30:00.9	\$ 50.08	\$ 50.08	\$ 50.08	Yes	100				
9:30:01.0	\$ 50.11	\$ 50.09	\$ 50.09	Yes	300				
9:30:01.1	\$ 50.09	\$ 50.09	\$ 50.09	Yes	200				
9:30:01.2	\$ 50.09	\$ 50.09	\$ 50.09	Yes	200				

Whole Credit (1 Second)
 Adjusted Price: \$50.08 (C) *
 Adjusted Size: 100 (H)
 = \$5,008.00 (I)