

The Effect of Amendment 10 of the “Limit Up-Limit Down” Pilot Plan

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ABSTRACT

This paper examines the effects of the Tenth Amendment² (“Amendment 10”) to the Limit Up-Limit Down (“LULD”) National Market System (“NMS”)³ Plan on trading pauses. Generally, the LULD Plan sets forth market-wide LULD requirements designed to prevent trades in an individual security from occurring outside specified price bands, set in relation to that security's defined reference price, coupled with trading pauses to temporarily halt trading and accommodate more fundamental price moves in the security. Amendment 10 to the LULD Plan altered the determination of a security's first reference price when the security does not trade in an opening auction to reduce the incidence of unnecessary trading pauses.⁴ We find that trading

¹ The U.S. Securities and Exchange Commission (“Commission” or “SEC”), as a matter of policy, disclaims responsibility for any private publication or statement of any of its employees. The views expressed in this White Paper are those of the author and do not necessarily reflect the views of the Commission or of the author's colleagues on the staff of the Commission. I prepared this white paper as a part of the Division of Economic and Risk Analysis (DERA) White Paper series. I thank my colleagues in DERA, especially Amy Edwards, for her helpful comments.

² See Joint Industry Plan; Order Approving the Tenth Amendment to the National Market System Plan to Address Extraordinary Market Volatility (“Amendment Order”) by BATS BZX Exchange, Inc., BATS BYX Exchange, Inc., Chicago Stock Exchange, Inc., Bats EDGA Exchange, Inc., Bats EDGX Exchange, Inc., Financial Industry Regulatory Authority, Inc., NASDAQ BX, Inc., NASDAQ PHLX LLC, The Nasdaq Stock Market LLC, National Stock Exchange, Inc., New York Stock Exchange, LLC, NYSE MKT LLC, and NYSE Arca, Inc., Release No. 34-77679 (April 21, 2016), 81 FR 24908 (April 27, 2016). See also Notice Filing, Release No. 34-77205 (Feb. 22, 2016), 81 FR 10315 (Feb. 22, 2016), Exhibit A.

³ See Order Approving, on a Pilot Basis, the National Market System Plan to Address Extraordinary Market Volatility (“Approval Order”) by BATS Exchange, Inc., BATS Y-Exchange, Inc., Chicago Board Options Exchange, Incorporated, Chicago Stock Exchange, Inc., EDGA Exchange, Inc., EDGX Exchange, Inc., Financial Industry Regulatory Authority, Inc., NASDAQ OMX BX, Inc., NASDAQ OMX PHLX LLC, The Nasdaq Stock Market LLC, National Stock Exchange, Inc., New York Stock Exchange LLC, NYSE MKT LLC, and NYSE Arca, Inc., Release No. 34-67091 (May 31, 2012), 77 FR 33498 (June 6, 2012) (File No. 4-631), Exhibit A (“the LULD Plan”). The LULD Plan and subsequent amendments are available at <https://www.sec.gov/rules/sro/nms.htm>.

See also additional white papers authored by DERA staff economists on the LULD Plan, including ““Limit Up-Limit Down” Pilot Plan and Associated Events” by Moise and Flaherty (2017) and ““Limit Up-Limit Down” Pilot Plan and Extraordinary Transitory Volatility” by Hughes, Ritter and Zhang (2017). The DERA White Paper series is available at <https://www.sec.gov/dera/staff-papers>.

⁴ See the Participants' Supplemental Joint Assessment (May 28, 2015), available at <http://www.sec.gov/comments/4-631/4631-39.pdf>. See also Comment Letter of Paul Roland, Principal, U.S.

pauses for both Tier 1 and Tier 2 securities were less frequent following the implementation of Amendment 10. The decrease in the frequency of trading pauses was largest for Tier 2 securities, relative to Tier 1, and also larger in the first 30 minutes after the opening of the trading day.

I. Introduction

The LULD Plan sets forth procedures that provide for market-wide limit-up limit down requirements designed to prevent trades in individual NMS Stocks from occurring outside of specified price bands, while allowing trading to continue when a price move is temporary. The Securities Information Processors (“SIPs” or “Processors”) responsible for consolidating information for each NMS security calculate the price bands for each stock.⁵ The price bands are determined using dynamic “Reference Prices,”⁶ based on moving averages of trade prices. The LULD Plan also provides for “Trading Pauses”⁷ to accommodate more fundamental price movements (as opposed to clearly erroneous trades or momentary gaps in liquidity). The Plan defines price bands for two distinct groups of securities: Tier 1 NMS Stocks (S&P 500, the Russell 1000, and some high volume exchange-traded products (ETPs)) and Tier 2 (the remainder of NMS stocks).

Under the LULD Plan, the first Reference Price for a security on a trading day is the opening price on the “Primary Listing Exchange”⁸ on which the security trades if a trade occurs less than five minutes after the start of regular trading hours. However, some securities may not have a trade setting an opening price within five minutes of the start of regular trading hours on the exchange. Prior to the implementation of Amendment 10, the opening Reference Price was set as the midpoint of the Primary Listing Exchange’s best bid and offer quotes under such circumstances.⁹

However, after the LULD Plan was implemented, but before Amendment 10, LULD Plan participants (the “Participants”)¹⁰ presented data that shows that use of the Primary Listing

Equities, Nasdaq, (Feb. 18, 2016). Comment Letter of Christopher B. Stone, Vice President, FINRA (May 28, 2015). LULD Plan comment letters are available at <http://www.sec.gov/comments/4-631/4-631.shtml>.

⁵ Price bands are calculated in accordance with Section V of the LULD Plan.

⁶ See Section V of the LULD Plan.

⁷ The operation of “Trading Pauses” is discussed in Section VII of the LULD Plan. Most Trading Pauses end within five minutes; however the LULD Plan permits Trading Pauses to be extended to 10 minutes. See Notice Filing p. 3.

⁸ See Section I.O of the LULD Plan.

⁹ See supra note 2.

¹⁰ Plan participants are Bats BZX Exchange, Inc., Bats BYX Exchange, Inc., Chicago Stock Exchange, Inc., Bats EDGA Exchange, Inc., Bats EDGX Exchange, Inc., Financial Industry Regulatory Authority, Inc., Nasdaq, Inc.,

Exchange's midpoint of the bid and offer often results in what the Participants believe is an unrealistic initial Reference Price.¹¹

The participants also noted that certain securities may open on quotes that are extremely wide,¹² which could trigger Limit States or Trading Pauses at reasonable price levels. For example, consider a security with a recent (previous day) trading price of \$5, which was also the price at which it closed on the previous trading day. At the start of the following trading day, however, it does not have an opening trade and its only available quotes are a bid of \$1 and an offer of \$20. Under the LULD Plan before Amendment 10, the initial Reference Price would be the midpoint of the bid and offer, \$10.50. If the security is in a 20 percent price band,¹³ the upper price band value would be \$12.60 and the lower price band value would be \$8.40. If a trader then offered to sell the stock at \$5, trading in the security would enter a "Limit State,"¹⁴ and, after 15 seconds, would likely enter a "Trading Pause" under the LULD Plan. The Trading Pause occurs even though the offer of \$5 is identical to the price at which the security closed at the end of the previous trading day.

Amendment 10, which was implemented on July 18, 2016,¹⁵ addresses this issue by setting a security's Reference Price to the Primary Listing Exchange's previous day's closing price when there is no opening transaction, or if no such closing price exists, the last sale on the Primary Listing Exchange.¹⁶ To extend the example from the previous paragraph, under Amendment 10, the security's Reference Price would be the closing price from the previous trading day of \$5. If the price bands were set at 20 percent, then the upper and lower price band values would be \$6 and \$4 respectively. If a trader offered to sell or bid to buy at \$5, then the security would not enter a Limit State or a Trading Pause.

NASDAQ BX, Inc., NASDAQ PHLX LLC, the Nasdaq Stock Market LLC, National Stock Exchange, Inc., the New York Stock Exchange LLC, NYSE MKT LLC, and NYSE Arca, Inc.

¹¹ See Notice Filing. See also the Participants' Supplemental Joint Assessment (May 28, 2105), available at <http://www.sec.gov/comments/4-631/4631-39.pdf>. See also Comment Letter of Paul Roland, Principal, U.S. Equities, Nasdaq, (Feb. 18, 2016). Comment Letter of Christopher B. Stone, Vice President, FINRA (May 28, 2015). LULD Plan comment letters are available at <http://www.sec.gov/comments/4-631/4-631.shtml>.

¹² See *id.*

¹³ The percentage deviation permitted from the Reference Price in the price bands is discussed in Section V of the LULD Plan.

¹⁴ See Section I.(C) of the LULD Plan.

¹⁵ See Amendment Order for the full text of the Amendment, as well as its date of execution.

¹⁶ See Notice Filing, Appendix A, Section I.I.

II. Overview of the Effect of LULD Amendment 10

The implementation of Amendment 10 was associated with a dramatic decrease in the number of Trading Pauses. Table 1 below presents the average number of Trading Pauses per day across all tickers,¹⁷ from May 12, 2014 (when the LULD Plan was fully implemented)¹⁸ to December 31, 2016.¹⁹ Table 1 shows that Trading Pauses decreased in frequency by approximately 80%, and that the decrease was statistically significant at the 1% level.

Table 1: LULD Trading Pauses Before and After Amendment 10

	Average Number of Trading Pauses per Trading Day before and after LULD Amendment 10		T-test between Before and After ²⁰
	Before	After	Difference
Tier 1	0.67 ²¹	0.27	- 0.40 ***
Tier 2	45.78	9.56	- 36.22 ***
Total	46.45	9.83	- 36.62 ***

¹⁷ The three Primary Listing Exchanges (BATS, Nasdaq, and the NYSE) provided the statistics used in this White Paper. The data source is a LULD Trading Pauses database provided by the Primary Listing Exchanges under Appendix B of the LULD Plan. Appendix B of the LULD Plan also includes data on each individual Limit State, Straddle State, and orders that arrived during each Limit State, in addition to data on Trading Pauses. Data used in this White Paper is from May 12, 2014 (when LULD was fully implemented) to December 31, 2016. Note that there were 549 trading days from May 12, 2014 until Amendment 10 was implemented on July 18, 2016, and that there were 117 trading days from July 18, 2016 until December 31, 2016. For purposes of this paper, we included only Trading Pauses that lasted at least five minutes. However, under Section VII of the LULD Plan, it is possible for a Trading Pause to last less than five minutes, if it begins within five minutes of the end of regular trading hours. Fewer than half of one percent of Trading Pauses last less than five minutes, and so their exclusion does not materially change any results presented.

¹⁸ See Moise and Flaherty, *supra* note 3, for more detailed information on the implementation schedule of the LULD Plan.

¹⁹ Note that data from August 24, 2015 is excluded from Table 1 and all other tables and presentations in this White Paper). For a discussion of the events of August 24, 2015, see "Research Note: Equity Market Volatility on August 24, 2015" Staff of the Securities and Exchange Commission Office of Analytics and Research, Division of Trading and Markets (Dec. 2015), available at https://www.sec.gov/marketstructure/research/equity_market_volatility.pdf

²⁰ Note that *** denotes statistical significance at the 1% level, ** denotes statistical significance at the 5% level, and * denotes statistical significance at the 10% level, for all tables in this White Paper.

²¹ See Moise and Flaherty, *supra* note 3, p. 45, for daily average numbers of Trading Pauses for the time period denoted as "LULD Phase II" that are lower than the figures presented in Table 1 above for the time period before LULD Amendment 10. This is because the time periods are different. "LULD Phase II" refers to the time period from May 12, 2014 until August 29, 2014. The "Before" column in Table 1 above refers to the time period from May 12, 2014 until before July 18, 2016 (not including August 24, 2015).

Figure 1 shows more detailed month-by-month data for the frequency of Trading Pauses. The figure clearly shows a significant decrease in frequency following the implementation of Amendment 10. Table 1 above also shows the average number of Trading Pauses per Trading Day for Tier 1 and Tier 2 securities. The LULD Plan defines different price bands for those two groups of securities.²² Tier 1 NMS Stocks include the components of the S&P 500, the Russell 1000, and some high volume exchange-traded products (ETPs). Tier 2 NMS stocks include all other NMS securities. Tier 2 stocks have price bands that are wider than stocks in Tier 1.²³ Approximately 98.5% of all LULD Trading Pauses occurred in Tier 2 stocks before Amendment 10 came into effect.²⁴ However, the decline in the average number of Trading Pauses per day was greater for Tier 2 securities (79%) than for Tier 1 securities (59%), but Tier 2 securities still account for 97% of Trading Pauses even after Amendment 10.

III. The Effect of LULD Amendment 10 on the Timing of Trading Pauses

Because Amendment 10 was designed to address the issue of Reference Prices for securities without an opening transaction, we expect that any decrease in the number of Trading Pauses would be especially evident at 9:30am, when the Principal Listing Exchanges typically open, and 9:45am, when price bands narrow.²⁵ The statistics presented in Table 2 below are consistent with this expectation, with larger decreases in the average number of Trading Pauses before 10:00am. Further, although the implementation of Amendment 10 is also associated with declines in Trading Pauses throughout the day, only the intervals from 9:30am to 9:35am and from 9:45am to 9:50am show a highly statistically significant decrease (at the 1% level) in the average number of Trading Pauses for both Tier 1 and Tier 2 securities.

Figures 2A and 2B show more detailed data on the distribution of the average number of Trading Pauses over the day in five minute increments of time, for both Tier 1 and Tier 2 securities. Although Trading Pauses are still more heavily concentrated near the beginning of the day even after the implementation of Amendment 10, that effect is less evident after the Amendment came into effect.

²² See Moise and Flaherty, *supra* note 3, for more detailed information on Tier 1 and Tier 2 securities, and the size of their price bands.

²³ See *id.*

²⁴ Note that the Trading Pauses on August 24, 2015 had a higher percentage of Tier 1 stocks. For example, 729 of the 1,081 Trading Pauses on the NYSE were in Tier 1 stocks.

²⁵ See Section V(A) of the LULD Plan.

Table 2: Trading Pauses by Time of Day Before and After Amendment 10

Interval in which Trading Pause began		Average Number of Trading Pauses per Trading Day before and after LULD Amendment 10					
		Tier 1			Tier 2		
Beginning by:	Ending before:	Before	After	Difference	Before	After	Difference
09:30AM	09:35AM	0.10	0.00	- 0.10 ***	7.16	0.56	- 6.60 ***
09:35AM	09:40AM	0.03	0.00	- 0.03	2.01	0.25	- 1.76 ***
09:40AM	09:45AM	0.03	0.00	- 0.03 *	1.23	0.17	- 1.06 ***
09:45AM	09:50AM	0.10	0.01	- 0.10 ***	11.52	1.76	- 9.75 ***
09:50AM	09:55AM	0.03	0.00	- 0.03 *	1.69	0.41	- 1.28 ***
09:55AM	10:00AM	0.03	0.00	- 0.03 *	1.36	0.17	- 1.18 ***
10:00AM	11:00AM	0.12	0.03	- 0.09 **	8.76	2.56	- 6.21 ***
11:00AM	12:00PM	0.06	0.04	- 0.01	4.01	1.27	- 2.74 ***
12:00PM	1:00PM	0.06	0.09	+ 0.03	2.65	0.62	- 2.03 ***
1:00PM	2:00PM	0.05	0.03	- 0.03	2.10	0.73	- 1.38 ***
2:00PM	3:00PM	0.03	0.05	+ 0.02	1.97	0.62	- 1.36 ***
3:00PM	4:00PM	0.03	0.03	- 0.01	1.33	0.45	- 0.87 ***
Total		0.67	0.27	- 0.40 ***	45.78	9.56	- 36.22 ***

Figure 1. Number of LULD Trading Pauses by Month

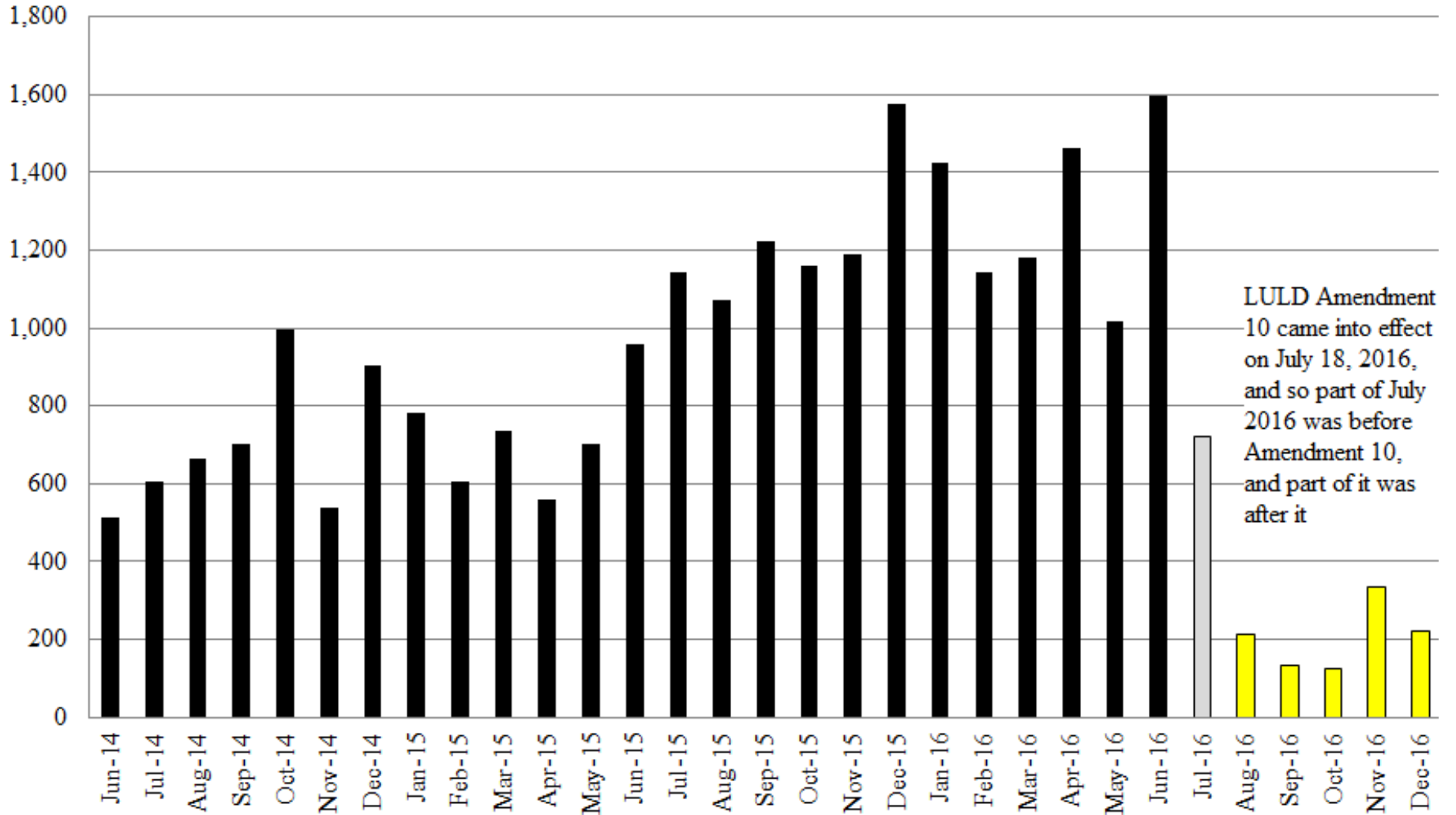


Figure 2A
Tier 1 Securities –
Average Number of Trading Pauses per Day, Over the Day, Before and After LULD Amendment 10

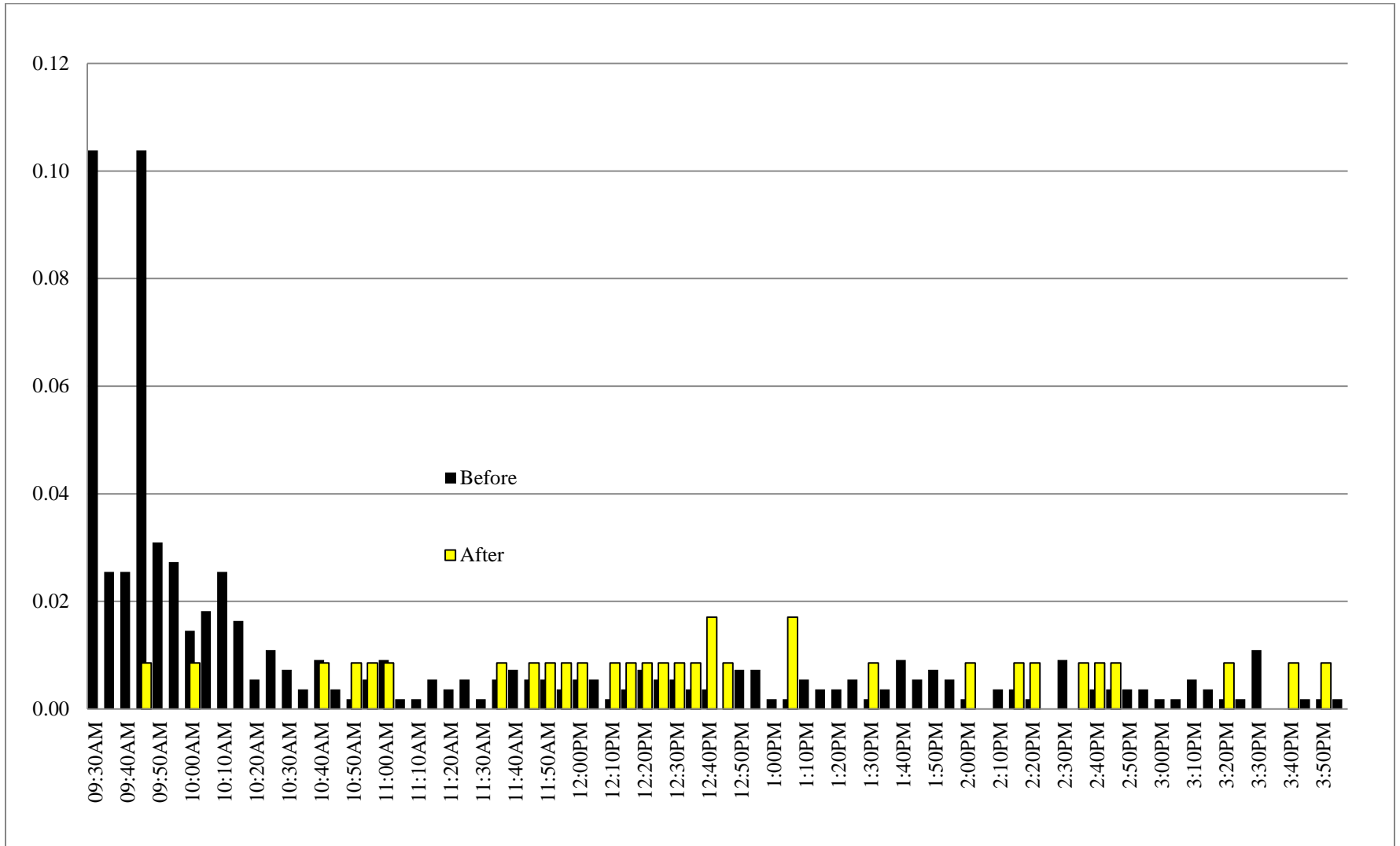


Figure 2B
Tier 2 Securities –
Average Number of Trading Pauses per Day, Over the Day, Before and After LULD Amendment 10

