

A low-angle, night-time photograph of the Nasdaq Tower in New York City. The building's facade is illuminated with bright blue and green lights, creating a vibrant, modern architectural look. The sky is dark, and other city lights are visible in the background. The overall mood is high-tech and dynamic.

NASDAQ ECONOMIC RESEARCH

MANAGING VOLATILITY FROM THE EXCHANGE POINT OF VIEW

APRIL, 2016



MANAGING VOLATILITY



OBJECTIVE WITH VOLATILITY MANAGEMENT

**MAINTAIN A FAIR
AND ORDERLY
MARKET!**

Non objectives:

- Avoid markets to go down
- Stop trading

What can cause volatility?

- Market factors
 - Events – News or other fundamental factors
 - Related markets volatility
- Mistakes
 - Exchange system problem
 - Member trading application goes wrong
 - Fat finger mistakes
- Market manipulation (out of scope)

RECENT MARKET INCIDENTS

Flash Crash - 2010

Knight Capital - 2012

US opening Aug - 2015

Chinese markets –
Autumn 2015



Each case is unique but have a few commonalities:

- Movement is very fast – in some movements it can be characterized as uncontrolled
- 10 years ago, in more manual markets, the development would have been different
- Large media coverage – to a large extent negative for the market
- Investors negative to the development and want to avoid this type of events

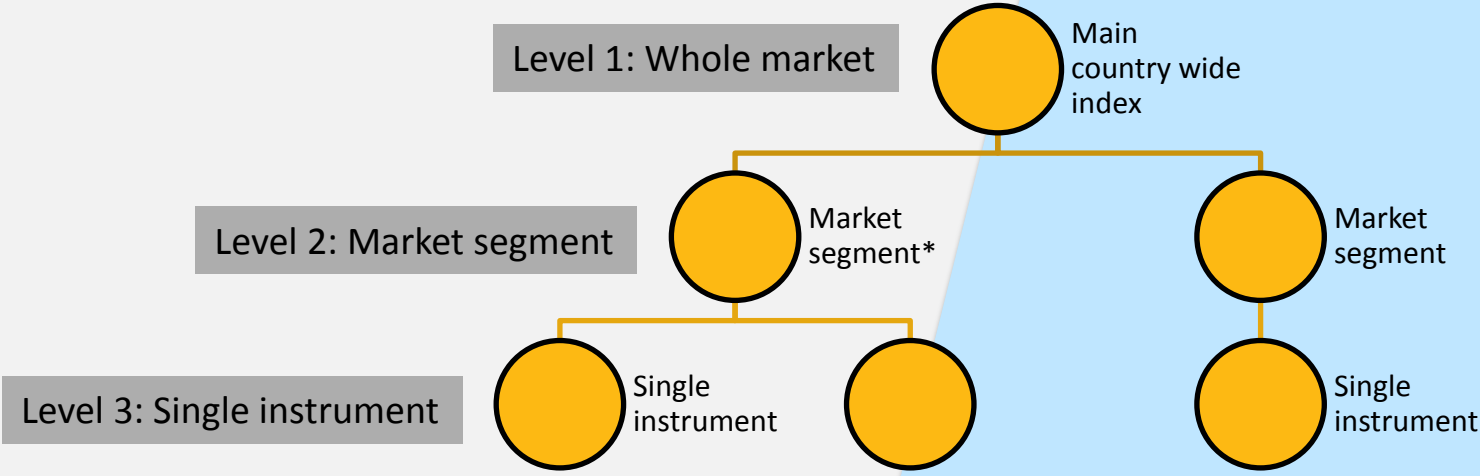


In principle all stakeholders have an interest in avoiding this type of events with extreme volatility in a short time frame

1. What to measure

WHAT TO MEASURE

- A market wide measurement may not be needed when there is measurement on lower level
- Single instrument measurement may be difficult to manage for participants if several instruments are volatile at the same time



*Market segment can be one exchange or a segment of a market (Telecom, Financial, etc.)

ACTIONS TO TAKE

3. Action to take

ACTIONS THE EXCHANGE CAN TAKE ONCE TRIGGERED:

- Halt the market for a while
 - Reopen usually done within 1 – 15 minutes
 - New reference price is the new opening price → Can be triggered several times a day
- Halt market and enter into special auction where price outside price band is disseminated (Japan)
- Close the market (for rest of day)

- Reject orders
- Trading inside price band – but not outside price band (US limit up – limit down)
- Kill switch – Removing one participant's orders

For movements

For pre trade risk checks

WHERE TO APPLY THE ACTION:

- Whole market
- Market segment
- Underlying plus derivatives
- Single instrument

The point of the reopening period is for investors to consider the situation:

- For institutional investors that make perfect sense. They will check with major clients, re-evaluate risk, new parameters for algos etc.
- A halt have a more limited value for retail investors

REOPENING

4. Reopening

- Trend towards view that the market should reopen
- Single instruments re-open in almost all markets
- Market wide stops have different rules
 - Some are reopening 1 time but not 2 times
 - Not reopen at all

REOPENING PROCESS:

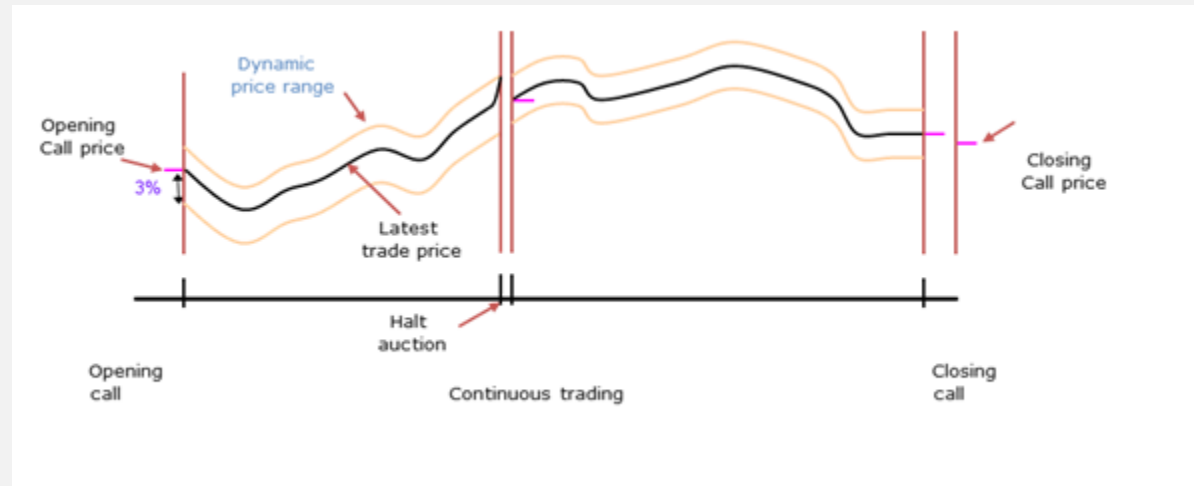
- The point of a temporary halt is that the market participants gets a few minutes to re-consider the situation.
- Opening is in most cases done with same auction model used in the morning auction (but shorter order collection time)
- A new reference price is established in the opening and used when measuring new volatility management

PRACTICAL EXAMPLES

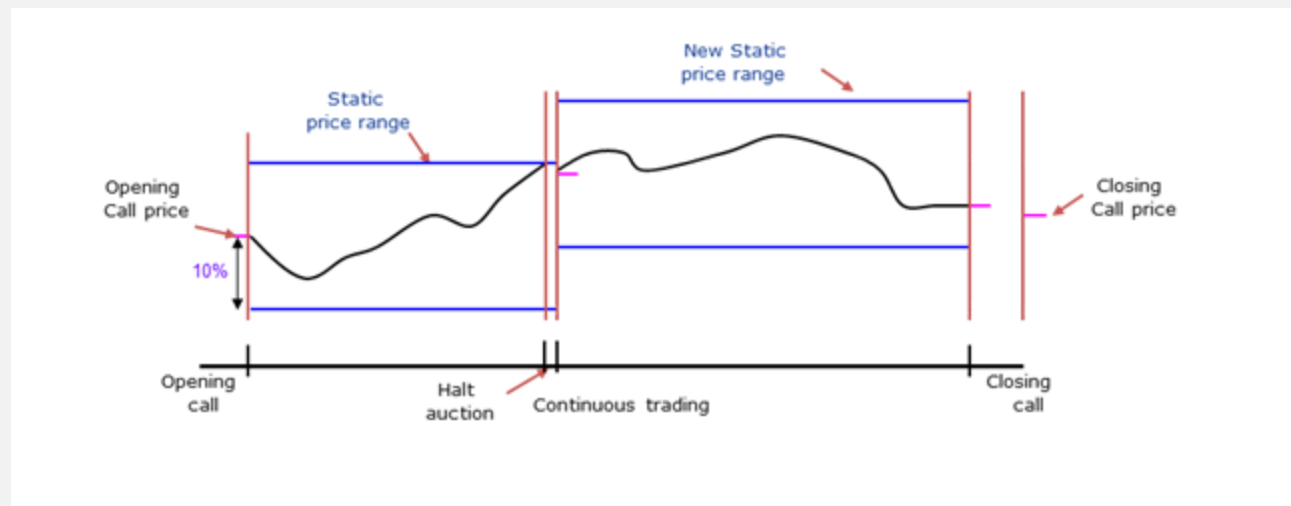


THE EUROPEAN MODEL

Dynamic volatility guard



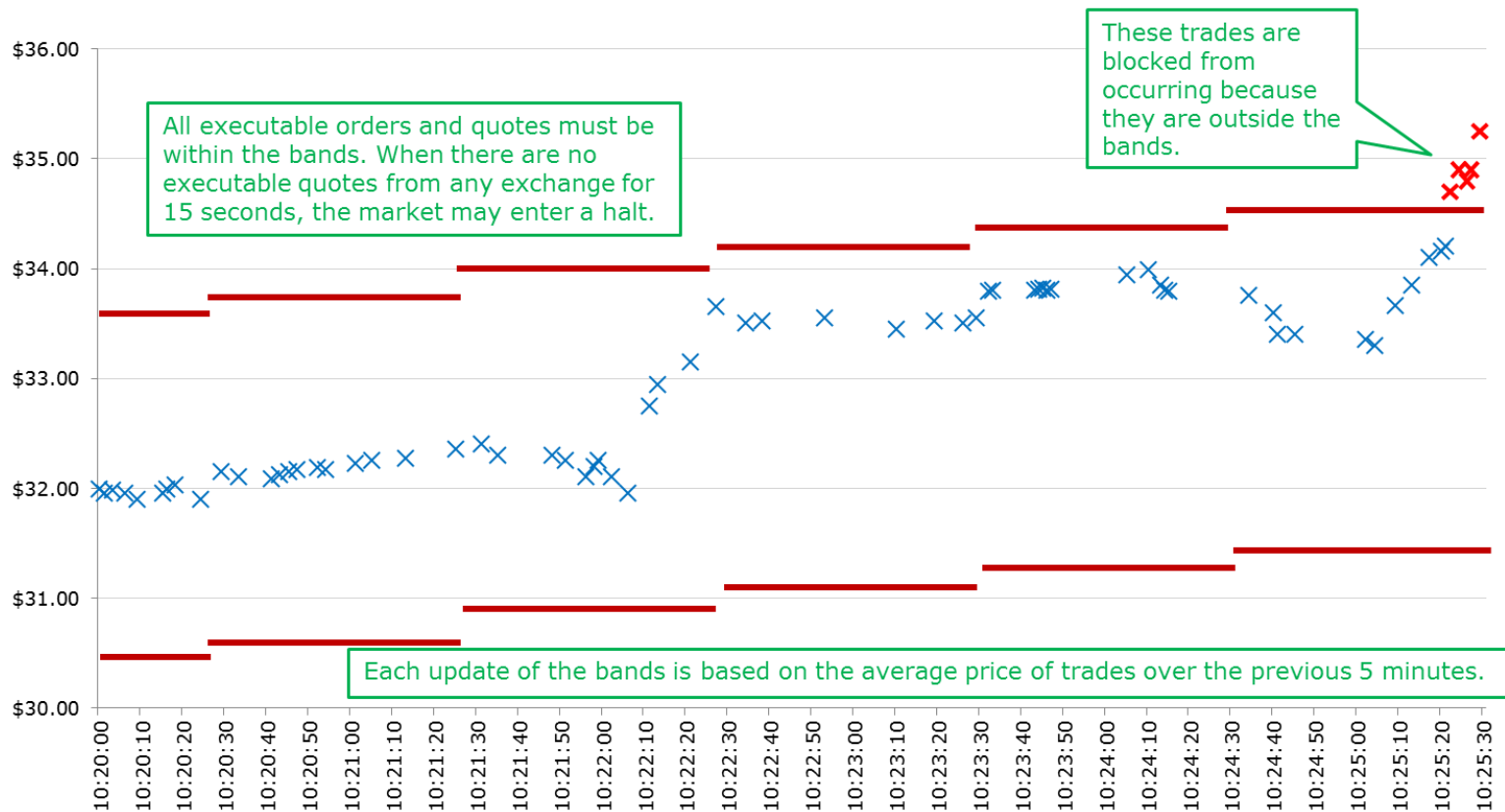
Static volatility guard



US EQUITY MARKET

| Market | Main purpose | 1. What | 2. How | 3. Action | 4. Next step | Other aspects |
|------------------|----------------|-----------------------|----------------------------------------------------------|---------------------------------------------------------------|------------------------------------------------------------------------|-----------------------------------------------------------------------------|
| US Equity | Market factors | Whole market | % from opening | Halt | Auction after 15 | Stops at 7%, 13% and 20% (close) Do not apply last 60 minutes of the day |
| US Equity | Market factors | Individual instrument | % from average last in the last rolling 5 minutes period | Limit state – Trades only within X % price band in 15 seconds | If order removed trading continues. If order remain halt for 5 minutes | |
| Nasdaq US Equity | Mistakes | All orders | Pre-trade risk - Limits set by member | Kill switch | Discuss with exchange | Member set up rules for their internal users and external clients |

LIMIT UP LIMIT DOWN – HOW IT WORKS



LIMIT UP LIMIT DOWN – DETAILS

- The listing exchange distributes price bands for each stock throughout the day
 - Bands are updated every 30 seconds
 - Bands are based on the average price over the previous 5 minutes adjusted up by a percentage to get the upper band and down by a percentage to get the lower band
 - The width of the bands depends on stock activity, price, and time of day
- No trading venue is allowed to execute trades outside the price bands
- Only orders and quotes within the bands are executable and eligible for National Best Bid and Offer (NBBO)
- If there are no executable orders within the the bands for 15 seconds, then the listing exchange announces a pause in trading of the stock
 - All trading venues must pause trading for 5 minutes
 - Pause ends with a re-opening auction by the listing exchange
 - Bands are re-set after the auction based on the auction price

Example:

Average price
over previous
5 minutes =
\$10.00

Percent
adjustment =
10%

Upper band =
\$11.00

Lower band =
\$9.00

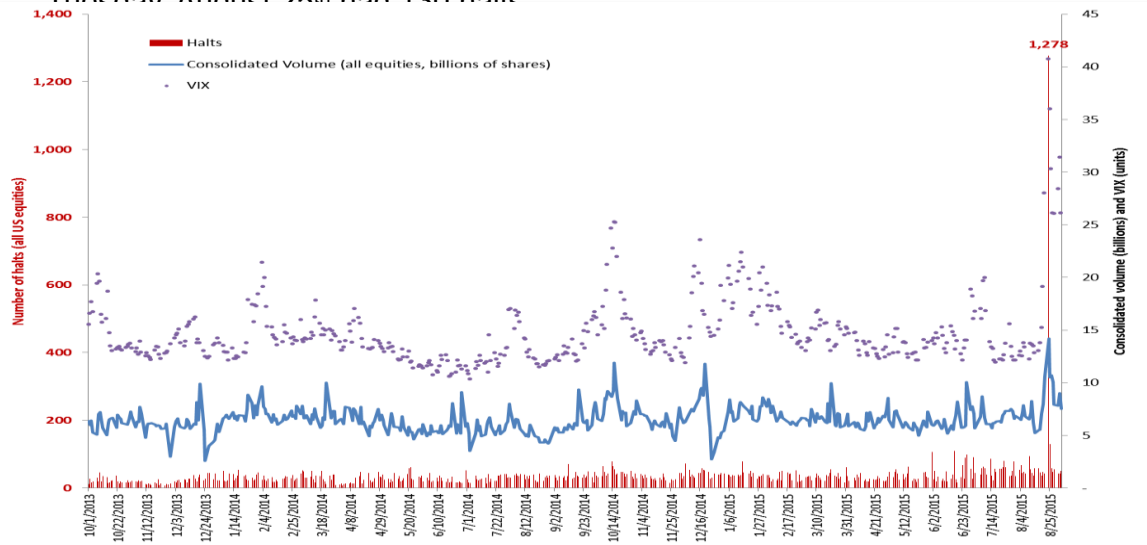
LIMIT UP LIMIT DOWN – EXPERIENCE ON AUGUST 24, 2015

LULD Halts

- A record 1,278 halts occurred on Aug 24th.
- 93% of halts on August 24th occurred before 10:30am
- 83% of halts were in ETFs, most of which were ARCX listed.
- 58% of the halts(*) were in stocks with market cap below \$100M
- Less than 1% of the halts were S&P 500 stocks.
- The most in one day before that date was 109.
- Tuesday, August 25th had 130 halts

LULD halts Aug 24, 2015

| Listing exchange | Day | ETFs | S&P 500 | Before 10:30 |
|------------------|--------------|--------------|----------|--------------|
| BATS | 3 | 3 | 0 | 3 |
| NASDAQ | 194 | 58 | 2 | 150 |
| NYSE | 78 | 0 | 6 | 73 |
| NYSE Arca | 999 | 999 | 0 | 958 |
| NYSE MKT | 4 | 0 | 0 | 4 |
| Total | 1,278 | 1,060 | 8 | 1,188 |
| Percent of cases | | 83% | 1% | 93% |



| Security Float | Halts(*) |
|---------------------|----------|
| < \$100 MIL | 101 |
| \$100 - \$250 MIL | 12 |
| \$250 - \$500 MIL | 10 |
| \$500 MIL - \$1 BIL | 9 |
| \$1 - \$5 BIL | 22 |
| \$5 - \$50 BIL | 15 |
| > \$50 BIL | 6 |

* Excluding ETF's

CONCLUSIONS



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There is no overall standard for how to manage volatility. There are differences to all four parts of the model:

1. Volatility is measured for instrument level and/or on market overall level
2. Different measurements apply on how to measure
3. Most markets halt and reopen after a while – you really want to avoid market close. Market close should be to protect from systematic risks
4. Reopen is usually done within 3 – 15 minutes using same process as market opening

