

Automated Testing of Algorithms for Contribution to Market Disorder

Why its Mandatory & How to Do it

Algorithmic Trading Governance & Controls Conference
Tuesday, 24 September 2019

Nick Idelson

Testing of Algorithms

- What does regulation make essential ?
- Why has this been mandated ?
- When does it need to be done ?
- How to do it ?
- What are the other benefits ?
- Consequences for non-compliance ?

Some Ancient History

- 1980
- 1986 (and 1987 and 1992)
- 2000
- 2003
- 2010 and 2014

Some More Recent European History

- **2012** ESMA Guidelines Systems and controls in an Automated Trading Environment...
- **2014** MiFID II & MAR Level 1 passed
- **2016** 3rd July MAR in force
- **2018**
 - 3rd Jan MiFID II in force
 - **12 Feb FCA Algorithmic Trading Compliance in Wholesale Markets**
 - 15 Jun PRA Algorithmic Trading

- **2013** HK SFC conclusions on Regulation of Electronic Trading
- **2014** 1st Jan HK SFC New Code of Conduct
 - with specific algo and market integrity requirements
- **2018** 13th April HK SFC reprimands and fine Instinet Pacific Limited HK\$17.3 million “for failures concerning its electronic and algorithmic trading systems”
- Failed to ensure reasonable controls were in place to prevent its algorithmic trading system from generating and passing erroneous and disorderly orders to the market on **three occasions** between December 2014 and January 2016

Meanwhile... Globally

- IOSCO and Market Integrity

What is an Algo / Financial Instruments ?

“algorithmic trading’ means trading in financial instruments where **a computer algorithm automatically determines individual parameters of orders** such as whether to initiate the order, the timing, price or quantity of the order or how to manage the order after its submission, with limited or no human intervention...”

- Excludes pure decision on venue but covers much/most ET
- What about SOR, quote copying, p&c ?
- Financial instruments defined in Section C of Annexe 1 MiFID II
- Vast range
- Similar algo regs can apply even to non-MiFID instruments
- Non-MiFID algos as key inputs to MiFID algos

What is mandated for Algo Testing

- MiFID II testing must be “clearly delineated” from development. (separate team)
- Professional documented software development standards generally expected
- Conformance testing with each venue required much more comprehensive than previously
- Entirely New Requirement - Testing for contribution to market disorder on each material / significant update of an algorithm

Testing for Contribution to Market Disorder

- Probably the hardest requirement in all of MiFID II
- A critical pillar of MiFID II - key to protecting market integrity
- Needs realistic market simulation and more
- RTS 6 and 7
- Feb FCA Review Paper

MIFID 2 – Algo testing requirements

- Trading venues will require their members “to certify that the algorithms they deploy have been tested to avoid contributing to or creating disorderly trading conditions” (RTS 7, Article 10, 1).
- Such tests and certification must be made both prior to initial deployment of algorithms and on any “substantial” update and a “person designated by senior management of the investment firm shall authorise the initial deployment or substantial update”(RTS 6, Article 5, 2).
- The member must also "explain the means used for that testing" (RTS 7, Article 10, 1).
- Additionally, as part of an annual assessment, the investment firms must retest their algorithms to “withstand increased order flows or market stresses” (RTS 6, Article 10).
- Shutdown of algorithms must be done “without creating disorderly trading conditions” (RTS 6, Article 14.3).
- The purpose of testing for disorderly trading conditions is to “recreate real market conditions to ensure the well-functioning of algorithms under changing circumstances” (3.2.33) and must include tests that show that the algorithm “can continue to work effectively in stressed market conditions” (3.1.16).

"Algorithmic Trading Compliance in Wholesale Markets"

"6.12 In considering the potential impact on market integrity, firms should also consider how they can examine market conduct considerations within their testing process.

Good practice

Firms who develop (or use third party) **dynamic testing environments**, that not only consider how their algorithmic trading strategies perform in a period of market disruption, but also assess whether their strategy further contributes (in combination with other trading activity) to market disruption.

Poor practice

Firms who conduct basic testing of their algorithmic trading strategies which only assess operational efficiency and focus on considerations such as their performance against certain benchmarks or the profit and loss of the strategy. In these cases, **firms are unable to demonstrate the potential impact of their algorithmic trading strategies on market integrity.**"

FCA Review Paper Feb 2018 - 2

"Algorithmic Trading Compliance in Wholesale Markets"

"1.9 Firms also need to consider the potential impact their algorithmic trading activity **(including the combined impact of multiple algorithmic strategies)** may have on the fair and effective operation of financial markets."

"1.16 Key objective: To ensure firms appropriately consider the potential impact of their algorithmic trading on market integrity, monitor for potential conduct issues and reduce market abuse risks"

mandated test requirements include:

"3.3 a clear methodology for testing and development, to ensure the algorithmic trading system or strategy:

- behaves only as intended
- complies with the firm's obligations
- complies with the rules of the relevant trading venue(s)
- **does not contribute to disorderly trading**
- works effectively in stressed market conditions"

"Algorithmic Trading Compliance in Wholesale Markets"

"3.5 Poor practice

Firms who don't consistently apply their development and testing process across all aspects of their business. For example, different trading desks and/or business lines use different methodologies."

"5.9 Good practice

Firms where algorithmic trading is fully understood by senior management, who play a key role in providing challenge across the business. For example, where **senior management are involved throughout the development and testing process** and actively seek to understand the potential market conduct implications."

So in addition to pass/fail outputs, needed so that firms can produce disorderly market testing reports to meet the RTS 6 and 7 requirements for trading venues (quickly and efficiently on any significant change in an algorithm), and to supply the relevant regulator with such evidence upon request its also important to have comprehensible drill down analysis) to help senior management to understand how the firm's algorithms may contribute to market disorder or commit market abuse.

FCA Review Paper Feb 2018 - 4

"Algorithmic Trading Compliance in Wholesale Markets"

"6.6 In addition to post-trade monitoring, firms need to be able to assess the potential impact new algorithmic trading strategies or systems may have on market integrity within the development and testing process. MiFID II sets certain requirements for firms to develop and test algorithms in Article 5 of RTS 6 of MIFID II to ensure they:

- do not behave in an unintended manner
- comply with the investment firm's obligations under this Regulation
- comply with the rules and systems of the trading venues accessed by the investment firm
- do not contribute to disorderly trading conditions, continue to work effectively in stressed market conditions and, where necessary under those conditions, allow for the switching off of the algorithmic trading system or trading algorithm"

"6.9 Poor practice

Firms who maintain basic market abuse alerts such as insider dealing or layering and spoofing but do not consider other types of market manipulation which can be associated with algorithmic trading. For example, momentum ignition, quote stuffing and reference price gaming.

"Algorithmic Trading Compliance in Wholesale Markets"

Poor practice

Firms who failed to identify where different strategies (on a combined basis) might create a false or misleading impression on the markets in which they operate."

"6.10 Good practice

Firms who include specific provisions within the approval process to consider the potential impact of algorithmic trading strategies and whether the proposal is deemed appropriate."

6.10 "In these examples, considerations are not limited to whether a strategy strictly meets the definition of market abuse. They also consider **whether the strategy would have a negative impact on the integrity of the market and/or if it would likely further contribute in scenarios where there is wider market disruption.**"

Testing for Contribution to Market Disorder

- **What is a “Dynamic Testing Environment” ? – part 1**
- In flash crashes it's not one algorithm but the interplay of different algorithms that cause and contribute to market disorder
- Conventional backtesting does not allow different algorithms' orders to interact
- **Dynamic Testing Environments must allow:**
 - Price to be moved by tested algorithm
 - Other algos to interact
 - Determine whether these interactions could cause or contribute to market disorder

Testing for Contribution to Market Disorder

- **What is a “Dynamic Testing Environment” ? – Part 2**
- Market Replay testing is NOT a Dynamic Test Environment
- Modified Market Replay testing is NOT a Dynamic Test Environment
- **A Dynamic Testing Environment IS:**
 - a simulation in which algos interact so must include simulated trading venues
 - In many cases needs to be a multi-venue simulation
 - Intended to be a realistic market ecosystem for the algos to be tested

Testing for Contribution to Market Disorder

- **What is needed ?**
- Realistic set of markets which respond to algo activity
- Tests “suitable” to test your specific algos
- Pass/Fail measures and approval process
- Certificates/Workflow compatible with Algo Inventory system
- Sufficient Info for testers, Senior management, trading venues and regulators

Does backtesting / market replay help ?

How did so many miss such an important requirement ?

How do you comply: Self-build, Vendor, Trading Venue

Testing for Contribution to Market Disorder

- **How to do a Simulation – Part 1**
- Sample Statistical Properties of every traded instrument on each traded venue – Create Price independent simulation
- Develop correlation and arbitrage linkages between the instruments cross venue
- Add RFQ agents and parent order injectors etc as required to complete a representative whole market ecosystem
- Develop a comprehensive set of stress tests and antagonist algorithms suitable for the algos you are testing

Testing for Contribution to Market Disorder

- **How to do a Simulation – Part 2**
- Develop and set suitable pass/fail criteria
- Certificate format for trading venues
- Embed into workflow for introducing new algos or making significant change
- Monitor the whole system to ensure it remains effective

Testing for Contribution to Market Disorder

- **How to do a Simulation ?**
- Job Done !
- A caveat: Protocol emulation
- **When does it need to be done by**
- Legally nearly 3rd January 2018 !
- Regulator & Legislator comments re: phased roll-out
- Here's One we built earlier

Automated Testing in Simulated Ecosystem



TraderServe AlgoGuard

Log Out

Test Plans Schedule Results



© Copyright 2000 - 2015 TraderServe Limited. All Rights Reserved.

Testing for Contribution to Market Disorder

- Demo Placeholder

Benefits of Market Simulation

- Comply with contribution to market disorder and market integrity regulations
- Help protect firms from self-inflicted and external events
- Improve algorithms robustness and effectiveness including market impact testing
- Conduct studies of market structure and rule changes

Market Manipulation

Includes:

- “Behaviour likely to create unfair trading conditions”
- “disrupting or delaying the functioning of the trading system of the trading venue”
- “entering orders which result in the overloading or destabilisation of the order book”
- Creating a false or misleading signal by entering orders to initiate or exacerbate a trend”
- Naïve, reckless or abusive algos / Attempted market manipulation

•

EU Penalties for non-compliance

- EU: Up to €5 million on individuals
- EU: €15 million or 15% of turnover on firms.
- EU(26): criminal sanctions of up to 4 year imprisonment under CSMAD
- EU: Industry bans
- Globally it can be worse !
- Extraterritoriality & Regulatory Cooperation

Testing Algos with Simulated Ecosystems

- Questions