Dark pools and toxicity assessment
Banking and capital markets
“Despite recent events focusing on the toxicity of dark pools, their benefits, if controlled, will continue attracting buy-side investors.”
Dark pools of liquidity (dark pools) are intended to provide a solution to facilitate the trading of large orders by institutional investors without moving the market, as the price and size of orders are unknown until the order has been filled. Some estimates suggest dark pool venues account for more than 30% of US and European equities trading volumes. As orders are matched internally, some operators offer clients improved pricing and reduced costs, negating the need to trade through a public exchange.

The reduced transparency of dark pools – by design – has led some to question whether users may be open to manipulation. In the US, multiple dark pool operators are being investigated for potentially violating the rules with which dark pools and alternative trading systems (ATSs) are expected to comply. Regulators in the UK and Asia are also increasing their scrutiny of dark pools and ATSs operated by global financial firms in their local jurisdictions. Such investigations could trigger substantial regulatory fines, with cases of legal action also underway.

Subsequently, there is now a heightened global focus on the way dark pools operate and the level of controls they have to safeguard the interest of their customers and investors. Operators of dark pools have begun to investigate internal systems and organizational behavior, and related control practices. Additionally, some are seeking independent advice and assurance.

This point of view examines:

► Impact on dark pool operators
► Key considerations
► How EY can help
Dark pool operators are facing increasing pressure from both customers and regulators. Customers are now asking to review the methodologies, rules and controls within the dark pool venues, and may move business away from venues that either do not have the controls in place, or cannot evidence the effectiveness of those controls.

Some of the potential next steps for clients and regulators are outlined below:

**Clients**

- Readjustment of buy-side trading strategies to reduce routing to dark pools, leading to potential drops in dark pool trading volumes
- More focused monitoring of routing strategies and due diligence in selecting trading venues
- Detailed analysis of order routing and pricing information to detect instances where they may be disadvantaged
- Intense scrutiny of marketing material for potential misrepresentations

**Regulators**

- Potential investigation of, and charges against, dark pool operators
- Increased scrutiny of dark pool operators for compliance with established regulatory rules and guidelines (e.g., Regulation National Market System (Reg NMS) and MiFID I)
- New rules and regulations for improving market transparency and disclosure, including additional reporting requirements (e.g., MiFID II)

**Independent controls review**

EY can assist firms by acting as the independent third-party reviewer in performing targeted assessments of their dark pools to uncover and address any gaps between expected and actual behaviors. EY can offer a number of reporting approaches, depending on the specific needs of the client, including:

- SOC2/SOC3 reports
- Formal EY reasonable or limited assurance opinions
- Findings and recommendations reports for management

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**Illustrative flow for EY’s Liquidity profiling matrix (LPM) model**

**Input**

Trade data

**Analyze**

EY’s analytical model  
Liquidity profiling model

**Implement**

Control framework
EY accelerator – Liquidity profiling matrix (LPM)

EY’s LPM model uses certain key quantitative measures to ascertain the toxicity of the venue. The model leverages an analytical framework to analyze the activities of the liquidity providers participating at the venue, which include banks’ own quant desks as well as external providers, such as high-frequency traders (HFTs). The framework uses specific measures for leakage, latency, gaming and others to generate a comprehensive venue quality index report. Based on the analysis, the model categorizes the liquidity providers and user profiles within the pool.

Trade data is gathered from the venue, and forensic data analysis will be performed based on key indicators. Each liquidity provider and user within the pool will be profiled accordingly.

Considerations

Analyzing quality inside the pool

While it is often assumed that dark pools will deliver a better trading performance by protecting clients’ anonymity, not all pools operate in the same way. Currently there are multiple approaches to pricing, connectivity, order types, types of clients, types of liquidity, market makers and control. All of these can influence the performance and benefits of a dark pool.

Dark pools benefit clients by providing liquidity that may not be displayed in lit markets. The perceived benefits of this anonymity include the prevention of information leakage, resulting in little or no price impact on the client order. Other considerations are price and size and whether the execution was best achieved inside the pool rather than a primary market. Conducting post-trade analysis is essential to understanding the value a dark pool delivers.

Intelligent direction

Some regulations direct the trade flow in certain directions, which we now understand may indirectly increase the potential for gaming. The next generation of smart routers will need to be more powerful than before and need to have relevant regulatory rules built in. Understanding toxicity beyond the dark pool will become essential. Therefore, built-in rules to intelligently direct flow to quality pools, and posting certain types of orders to pools where that order is likely to benefit, will become standard.

Understanding toxicity

A firm’s internal toxicity analysis within a dark pool is not often made publicly available. This has contributed to the recent challenges with the perception of the pool’s authentication and of their true effectiveness. We recommend all firms perform daily monitoring of toxicity levels and weekly reclassification of participants’ risk profiles. There are many variables that contribute to the variance in the quality of pools, including the type of flow and participants in the pool; the types of trades being done; market making; and the volatility and momentum of the stock. Deeper analysis is needed to truly understand these variables and their impact on toxicity within individual pools.

It is recommended that operators initiate independent reviews and assessments to uncover any key gaps against client expectations and/or regulatory compliance. Recommendations to remediate the gaps based on industry practices, trends and regulatory expectations will be provided.

Regulators will likely mandate firms to perform some of these assessments; a proactive approach will help restore confidence and trust with investors and regulators, and could reduce the risk, or cost, of future enforcement action.

Process and controls

Dark pool operators should consider testing the operating effectiveness of their processes and controls to ensure that they are being performed in line with documented procedures. Any control weaknesses, or breaches of controls identified, should be remediated. Such reviews will help manage operational and regulatory risk, and may also increase the confidence of users of the dark pool.
## What operators should be doing

<table>
<thead>
<tr>
<th>Assessment/ review type</th>
<th>Description</th>
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<tbody>
<tr>
<td>Toxicity assessment</td>
<td>Perform a quantitative evaluation of a dark pool’s toxicity, measuring whether the dark pool disadvantages its investors through providing preference to HFTs</td>
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<tr>
<td>Customer disclosure assessment</td>
<td>Analyze and assess whether the dark pool is operating accurately and consistently with disclosed practices</td>
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<tr>
<td>Functional quality assessment</td>
<td>Assess the dark pool’s functional quality and accuracy, including a comparative analysis of requirements and specifications versus results</td>
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<tr>
<td>Surveillance control framework assessment</td>
<td>Assess and enhance the dark pool’s existing surveillance controls to detect and prevent predatory behavior</td>
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<tr>
<td>Form ATS disclosure review</td>
<td>Review disclosures made in SEC Form ATS and validate whether the dark pool functionalities match documented behavior</td>
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<tr>
<td>Reg NMS/MiFID health check review</td>
<td>Assess the dark pool’s operation against specific requirements of Reg NMS and MiFID</td>
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<tr>
<td>Regulatory inquiry response</td>
<td>Assist in preparing responses to subpoenas, formal Requests for Information (RFI), independent assessments and other regulatory requests</td>
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<tr>
<td>Investigations</td>
<td>Assist counsel with a factual, often privileged, investigation of alleged wrongdoing, including, but not limited to, investigation of alleged misconduct in connection with sales and trading activity</td>
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<tr>
<td>Information governance and discovery</td>
<td>Assist with large, complex disputes involving volumes of electronic records, transaction data, email, paper and other forms of data</td>
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<tr>
<td>Internal control design</td>
<td>Assist in designing sustainable internal control framework and implementing front-to-back control processes</td>
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<tr>
<td>Risk and control assessment</td>
<td>Assist in designing and performing risk and control assessment against leading practices, and developing remediation roadmaps</td>
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<tr>
<td>Infrastructure assessment</td>
<td>Assist in assessing control and risk management of supporting trading infrastructure</td>
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### Key activities

#### Assess potential for:
- Information leakage, e.g., HFTs front-running customer orders through large order detection
- Latency arbitrage, e.g., low-latency HFTs using high speeds to trade ahead of customer orders
- Gaming, e.g., algorithms detecting large orders and manipulating the limit order book
- Review of all marketing documentation to identify advertised customer disclosures
- Assess expected versus actual behavior through development of scenario inventory and test cases
- Identify gaps in behavior and provide appropriate recommendations to address gaps
- Review all internal documentation, e.g., business requirements, functional specifications, to identify documented functionalities
- Assess expected versus actual behavior through development of scenario inventory and test cases
- Identify gaps in behavior and provide appropriate recommendations to address gaps
- Identify and catalog existing preventative and detective surveillance controls
- Assess coverage and completeness across identified controls, and the design effectiveness of key controls
- Document key gaps and develop remediation recommendations
- Review Form ATS, understand existing functionality and identify critical areas, e.g., order types, designations, policy and procedures, that need to be tested
- Develop, execute, and document test scripts to validate Form ATS functionality claims
- Review relevant policies and procedures, e.g., Automated Confirmation of Transactions (ACT) reporting, subscriber access approval, trade surveillance, fair access provision
- Identify and catalog existing preventative and detective surveillance controls for compliance with Reg NMS and MiFID rules, e.g., best execution, trade through
- Assess coverage and completeness across identified controls, and the design effectiveness of key controls
- Document key gaps and develop remediation recommendations
- Work with stakeholders (typically in-house or external counsel) to review regulatory requests for information relating to ATS activity
- Identify relevant data sources and coordinate data preservation, retrieval, validation, and analysis
- Prepare requested calculations where applicable and assist with preparation of formal response to regulatory body
- Prepare independent report of findings, damages, recommendations for remediation, process improvements, etc.
- Assist with factual investigation and analysis of alleged violations of regulatory requirements of corporate policies
- Forensic accounting and data analysis
- Damage analysis and quantification (and, if needed, expert reports and testimony)
- Prepare for, and respond effectively to, legal discovery demands through the application of appropriate processes and controls to information
- Perform time-critical preservation and collection activities anywhere in the world, including in multiple locations on different continents simultaneously
- Develop Electronically Stored Information (ESI) maps to rapidly identify information that is potentially impacted by litigation or a regulatory inquiry
- Design internal control framework and target operating model across lines of defense
- Implement front-to-back control processes across functional areas
- Develop policies and procedures for compliance and internal controls for lines of business and supporting functions
- Evaluate risk management framework of high-frequency trading algorithms
- Develop risk and control assessment template to test control effectiveness
- Assess risk and control effectiveness across lines of defense
- Assess internal audit and compliance readiness
- Assess the capacity, integrity, resilience, and security of supporting trading infrastructure
Illustrative case study – ATS review

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Services</th>
<th>Value to client</th>
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</thead>
<tbody>
<tr>
<td>A major US-based broker-dealer engaged EY to:</td>
<td>How EY responded:</td>
<td>This initiative offered the following benefits to the client:</td>
</tr>
<tr>
<td>1. Perform an independent assessment, validation and testing of their low-latency Financial Information exchange (FIX) protocol-based dark pool</td>
<td>► Assembled a delivery team consisting of three individuals with extensive electronic trading experience and an advanced knowledge of FIX protocol and Reg NMS</td>
<td>► Identification of key gaps between Form ATS and actual functionality, leading to revision of Form ATS and avoidance of potential regulatory actions</td>
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<td>2. Verify the veracity of claims made in SEC Form ATS, specifically around the dark pool’s compliance with trade-through and best-execution rules of local US regulation, Reg NMS</td>
<td>► Conducted a series of discussions with appropriate stakeholders, business and compliance owners to review the latest Form ATS, understand the dark pool’s current functionality and identify the critical areas (e.g., order types, designations, policy and procedures) that need to be tested</td>
<td>► Reusable and repeatable FIX-based test cases and scripts for ongoing testing</td>
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<td>The assessment was primarily focused on verifying the functionality and operational claims and statements that the firm made as a part of the annual Form ATS submission to the SEC. Some of the key functionalities to be tested included support for:</td>
<td>► Created, executed and documented detailed test scripts to validate the dark pool’s functionality claims submitted to SEC in Form ATS. Tested functionality included order types (limit, market, pegged, discretionary), time in force (day, Good-Till-Canceled (GTC), add liquidity only (ALO) and counter-party price improvement (CPPI) designations, and inter-market sweep orders (ISOs)</td>
<td>► Consolidated test results for presentation to regulators</td>
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<td>► Multiple order types, e.g., limit, market, resident limit, resident market, pegged and discretionary</td>
<td>► Reviewed policies and procedures for ACT reporting, subscriber access approval, trade surveillance of Reg NMS violations and Fair Access provision</td>
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<td>► Multiple order designations and instructions, e.g., counterparty price improvement, add liquidity only</td>
<td>► Documented and communicated relevant gaps to senior management, product development team and compliance</td>
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<td>► Probability-weighed matching logic</td>
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<td>► Mixed and odd lots</td>
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<td>► Restriction on crossings between specific counterparties</td>
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<td>► Regulation NMS compliance (best execution, trade through and sub-penny pricing)</td>
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<td>Additionally, the testing also included reviewing the policies and procedures for the ATS, specifically around:</td>
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<td>► Order flow management surveillance</td>
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<td>► Programing reviews and documentation</td>
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<td>► ACT reporting</td>
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<td>► Subscriber access approval</td>
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## Illustrative case study – electronic trading system risk and controls assessment

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<tr>
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<th>Value to client</th>
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| EY assisted a leading electronic trading firm in the US to conduct an independent assessment of the adequacy and efficacy of the US and non-US equities trading system, including its subsidiaries. The engagement assessed risks and controls for the following processes:  
1. Threshold limits  
2. Algorithm development  
3. Incident management  
4. Testing  
5. Change requests  
The assessment’s objectives were primarily to:  
► Identify potential risk exposure  
► Provide insight into improvement opportunities in the equities trading platform  
| How EY responded:  
► Provided documentation for the design and development, risk controls, and risk management policies and procedures related to the pathways of orders coming into the trading systems (e.g., trading desks, computer-to-computer, connections and front-end inputs)  
► Provided validation, acceptance, risk and controls related to order, risk management, monitoring, threshold setting/tuning, issue detection, incident response management and kill switches  
► Analyzed the end-to-end design, development, general IT controls and software quality assurance (SQA) cycle for the trading system. Specific advice given on use of new technology and enhancements to algorithmic trading risk controls.  
► Reviewed policies and procedures for responding to errors or failures relating to electronic trading systems – for example, trade desk operations, infrastructure monitoring, systems development, market access rule 15c3-5, detection of control failures and IT general controls.  
► Developed policies and procedures for monitoring the trading environment, including controls related to Rule 15c3-5 under the Securities Exchange Act of 1934 (Market Access Rule)  
| This initiative offered the following benefits to the client:  
► Assisted the client with defining a prioritized recommendations matrix mapped to their process flows and narrative  
► Provided observations, risks and recommendations for management’s consideration across 11 key areas  
► Suggested process flows, narratives and risk and control matrices (RCMs) for management’s consideration  
|
### Illustrative case study – regulatory inquiry response

**Objectives**

A major regulator issued formal Requests For Information (RFI) in connection with an industry-wide investigation of historical trading activity in certain complex securities. EY assisted the trading division of a leading, global financial institution with their response to the RFI.

The scope and objective of the RFI included the following:

- Analysis of historical trading activity spanning multiple years
- Review of voluminous portfolio of complex instruments and trading strategies
- Calculation of summary statistics using a complex, multi-phased, and iterative methodology prescribed by the regulatory agency
- Detailed documentation of the specific data extraction queries and scripts to verify that the relevant set of actions were performed

**Services**

How EY responded:

- Assembled a multi-disciplined delivery team consisting of forensic accountants and professionals with trade operations experience and product-specific knowledge
- Worked collaboratively with various stakeholders including internal and external counsels, business line management, trade operations and IT personnel to identify and obtain key information responsive to the RFI
- Developed a map of relevant data sources maintained in disparate systems, e.g., trade data, counterparty details and historical pricing were maintained in disparate systems
- Developed, executed and documented detailed extraction queries and computations in line with expectations set forth in the regulatory RFI

**Value to client**

This initiative offered the following benefits to the client:

- Identified gaps between information requested in the RFI and available records which facilitated dialogue with, and formal clarification issued by the regulator
- Worked with trade operations personnel to address unforeseen challenges such as the restoration of previously decommissioned legacy systems and developing a post-restoration assessment of data integrity
- Assisted counsel in preparing a comprehensive reporting package for the formal response to the regulator’s RFI
Dark pool operators are facing increasing pressure from their clients and regulators. As a result of recent events, operators are looking at reshaping service models, including increasing focus on surveillance to ensure fair markets. If they are successful, then these venues are likely to grow to be an even more important part of the trading process, enabling the buy-side to deliver price improvement and liquidity while protecting anonymity.

EY believes that firms can restore trust in their dark pool operations and also gain an advantage over their peers by using third-party reviews of processes and controls. Where issues are identified by the reviews – e.g., sub-optimal controls – early remediation will be possible. Firms may also be able to better manage inquiries and reviews by regulators where they have been proactive.

Conclusion

How EY can help

EY can help firms consider the following regulatory and client concerns in order to restore trust in their operations:

► Are there robust controls to safeguard client interests against predatory practices?
 ► Does the dark pool operate consistently in accordance with client marketing material?
 ► Is the dark pool compliant with mandated rules and regulations (e.g., Reg NMS and MiFID II)?

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EYG No. EK0345

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