



# **GenAI in the Derivatives Market: a Future Perspective**

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## EXECUTIVE SUMMARY

This whitepaper sets out guidance for industry stakeholders, regulators and technology providers seeking to harness the power of generative artificial intelligence (genAI) in transforming the over-the-counter (OTC) derivatives market. It discusses promising use cases for this technology in the OTC derivatives market, the risks of such technology, the current regulatory framework and potential risk mitigation solutions. By embracing genAI, organizations can unlock new opportunities for efficiency, innovation and compliance in an increasingly complex market.

GenAI is rapidly becoming a useful tool across industries, with the ability to significantly reduce the time taken to produce work. As an example of the power of such a tool in summarizing concepts and information, genAI was used to synthesize the research and writing of more than 30 individuals in the ISDA Future Leaders in Derivatives 2023-2024 cohort for several sections of this whitepaper. All of the information was subsequently checked by the cohort to ensure the final paper reflects their research.

There are several promising use cases for genAI in the derivatives market. The first relates to its ability to create new language based on precedent and synthesize data into a human-readable summary. GenAI is a useful tool for market participants to summarize complex derivatives agreements and suggest clauses based on deal terms and firms' existing precedent agreements, which has the potential to significantly decrease negotiation and drafting costs. In addition, genAI can be used to extract unstructured data from derivatives documentation to provide summaries of derivatives transactions required for operations and front-office processes.

GenAI can also synthesize various jurisdictional regulations and present these in an easy-to-read format, comply with industry or firm standards and provide checks against trades and trade documentation. While not a replacement for a human lawyer, it can significantly accelerate the review process and act as an additional regulatory compliance check.

The second use case identified is with respect to genAI's use in application development to propose new code changes. McKinsey has estimated that using genAI in this way can make coding up to 56% faster<sup>1</sup>.

The third use case is to analyze data, including nuanced human emotion data, to provide market insights that can be useful in trading.

The fourth use case is to improve operational efficiencies, such as to summarize margin and collateral requirements for the business and assist in selecting the least costly collateral or create synthetic data that can be used for model testing.

Finally, genAI can be used to assist in the development of derivatives markets in emerging markets, by aiding firms in summarizing local regulations and market conditions, paving the way for a more efficient entry into such markets.

Governments are also looking at use cases for genAI and proposing regulations to safeguard consumers and financial markets. These proposals are still in their infancy, but reviewing the current state shows the direction in which regulators and policymakers are heading.

<sup>1</sup> The economic potential of generative AI: The next productivity frontier, McKinsey Digital, June 14, 2023, [www.mckinsey.com/capabilities/mckinsey-digital/our-insights/the-economic-potential-of-generative-ai-the-next-productivity-frontier](https://www.mckinsey.com/capabilities/mckinsey-digital/our-insights/the-economic-potential-of-generative-ai-the-next-productivity-frontier)

While these use cases offer great efficiencies, the use of genAI does not come without its challenges and risks. Due to the nature of genAI and the large amount of data needed to train the models, data breaches can be a significant challenge and lead to reputational, confidentiality, intellectual property and legal risks. The use of genAI for trading can also create regulatory issues and, without proper oversight, could lead to fines and sanctions from financial regulators. Additionally, genAI is associated with producing bias and could be used to discriminate against protected classes, leading to civil and possible criminal liability for companies. Lastly, there is significant risk of model failure, in which the results produced are sub-standard or simply false. This could lead to erroneous trades and diminished trust within a financial institution.

There are steps companies can take to mitigate these challenges and risks. This paper concludes with a set of proposed best practices. Firms are encouraged to formulate a comprehensive governance framework for their own use of genAI and that of their third-party vendors. In addition, companies should ensure the recommendations and presentation of material produced by AI are acted upon only by humans who can take responsibility for the ultimate decisions of the company. Firms should implement comprehensive cyber security and data security policies to safeguard their IT systems from cyberattacks and malicious use of genAI technology. Lastly, firms should develop model risk mitigation policies to ensure the models conform to expected results and any deviation or failure can be quickly corrected.

## INTRODUCTION

The OTC derivatives market is a cornerstone of global finance, facilitating risk management, hedging and price discovery for a wide range of assets and liabilities. Despite its pivotal role, the industry grapples with certain challenges, including operational inefficiencies, regulatory complexities and risk management concerns. The emergence of genAI presents a transformative opportunity to revolutionize traditional practices and drive innovation. By harnessing the power of genAI, market participants can unlock new avenues for efficiency, transparency and compliance, reshaping the future of OTC derivatives trading.

This whitepaper explores the potential of genAI to address key industry challenges, offering insights into its applications, benefits, challenges and future outlook. Through a comprehensive analysis, it provides stakeholders with a roadmap for leveraging genAI to navigate the evolving landscape for OTC derivatives trading.

### What is GenAI?

GenAI is a novel set of algorithms that can automatically generate new content by synthesizing existing content. Unlike traditional AI models, which rely on pre-existing data sets to make predictions or classifications, genAI has the unique ability to create entirely novel content based on patterns learned from training data. Such a powerful tool can be used to improve operational efficiency throughout the derivatives industry, as well as assist market participants in their risk mitigation practices.

### Definition and Characteristics

At its core, genAI leverages techniques such as generative adversarial networks, variational autoencoders and deep reinforcement learning to simulate creative processes akin to human imagination. By synthesizing new data points or scenarios, genAI enables applications ranging from image generation and natural language processing to drug discovery and financial modelling.

Key characteristics of genAI include:

- **Creativity:** GenAI can produce novel content that exhibits creativity and originality, challenging traditional notions of AI as mere pattern recognition.
- **Adaptability:** GenAI models can adapt to changing environments and data distributions, allowing for continuous learning and improvement over time.
- **Uncertainty handling:** Unlike deterministic AI models, genAI acknowledges and quantifies uncertainty, providing probabilistic outputs that reflect the model's confidence in its predictions.

### Evolution and Technological Advances

The development of genAI has been driven by advances in deep learning architectures, computational resources and algorithmic innovations. Over the past decade, researchers have made significant strides in improving the stability, scalability and performance of generative models, paving the way for widespread adoption across various domains.

Technological advances such as attention mechanisms, transformer architectures and self-supervised learning have contributed to the success of genAI in generating high-fidelity and diverse outputs. Moreover, the availability of large-scale data sets and open-source frameworks has democratized access to genAI, empowering researchers and practitioners to explore its potential applications.

## IDENTIFYING POTENTIAL USE CASES IN THE DERIVATIVES INDUSTRY

The derivatives industry stands on the cusp of a technological revolution, poised to harness the transformative power of genAI to address longstanding challenges and unlock new opportunities for innovation. This section explores the diverse range of potential use cases where genAI can drive value creation and reshape traditional practices across the derivatives ecosystem. From automated trading strategies and risk management to regulatory compliance and market surveillance, genAI could transform the ways in which derivatives are traded, managed and regulated in the digital age. This section explores these use cases, providing stakeholders with insights into the tangible benefits and opportunities genAI can offer.

### A. Language Creation and Summation

GenAI is particularly beneficial in language creation and summation for human understanding of written content, including complex legal documentation, correspondence and unstructured data.

#### Derivatives Document Creation

With its ability to summarize and generate content, genAI has the potential to assist market participants with the drafting and negotiation of derivatives agreements and documentation. The process of translating trade data and a firm's internal deal terms into trade confirmations can be time-consuming and manually intensive, particularly for complex or non-standard trades. This presents challenges including risk of human error, inconsistencies, high operational costs and operational inefficiencies in meeting regulatory or audit requirements.

To assist in document drafting, genAI models could be trained on data, including industry standard documentation, a firm's preferred clauses and supplements and a firm's precedent confirmations. When new products, commercial terms or counterparties are introduced, genAI would be able to generate template confirmations using the appropriate terminology and language preferred by the firm's legal department. Such documents can be populated with clauses that are relevant to the specific counterparty and jurisdictions and the model can suggest provisions to reflect specific or bespoke deal terms.

GenAI can also assist in derivatives agreement and documentation negotiation processes, which can be resource-intensive and time-consuming. For example, where a counterparty requests a change to a provision, a model could consider the firm's position, known market standards, precedents and accepted contractual language or deal terms, and then synthesize those inputs to produce a draft response and description of potential implications to the trade or trading relationship. The benefit of using genAI in these instances is that the process will be quicker and also serves to ensure consistency (to align contracts with established precedents and market standards), without the need for a negotiator to seek past precedents for a more laborious manual review. It can also provide options with respect to the proposed response(s) based on certain parameters according to a firm's risk appetite and considering these key issues.

GenAI can be used to proof-read legal agreements and related documentation (eg, disclosures, definitions, protocol amendments) and to flag inconsistencies within documentation and deviation from established precedents or market standards. This can help to improve internal coherence and reduce human errors in drafting. It can also be used to review documents for the purposes of preparing an issues list for discussion and can help a firm to prepare talking points or arguments for its position on each issue, considering the rationale for each party's position, the history of the negotiation, or other provisions that mitigate the impact of the issues.

Once a given legal agreement is fully negotiated and completed, genAI can automate administrative tasks such as finalizing the document, preparing and sending out signature pages, automatically dating the document on receipt of signatures and preparing the pre-print portion of the documents. This reduces the administrative burden, saves time and minimizes the risk of errors. It can also revise simple grammar and formatting issues to ensure the final document is a more polished product.

#### Unstructured Data Extraction

The emergence of genAI presents an opportunity to improve the integration of existing data and documentation into universally agreed-upon data frameworks and standards. The Common Domain Model (CDM)<sup>2</sup>, for example, serves as a framework in which the trade components and lifecycle events for derivatives and other financial instruments may be digitally represented, with the aim of providing a common digital standard across the industry. This digital representation can be used to enhance transparency and facilitate interpretability across financial institutions and market utilities.

The CDM is fully open source<sup>3</sup>, but there are inherent challenges with the model's integration into existing systems. Integration issues may stem from the conversion of unstructured, qualitative data found in various documents. The need for standardization arises from the number of documents relevant to the lifecycle servicing of derivatives, such as master confirmation agreements (MCAs). Some products may not have standardized confirmation templates<sup>4</sup>, and even standardized MCA templates can have many pages of unstructured terms<sup>5</sup>.

For this category of unstructured documents to be maintained for derivatives processing, and to be integrated into structured, tabular data frameworks, repositories and common data models, it has been necessary for operations teams to undertake a laborious manual effort. To help address these challenges, genAI models could be trained to automate the process by which physical documentation, unstructured trade data and non-standard terms are translated into structured tabular outputs that adhere to the industry's universal data frameworks and standards (eg, the CDM or jurisdictional trade repository requirements) by analyzing data patterns and identifying where data elements are missing or require enrichment in order to meet the relevant requirements<sup>6</sup>.

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<sup>2</sup> Common Domain Model, [cdm.finos.org](http://cdm.finos.org)

<sup>3</sup> FINOS launches Common Domain Model Project in Partnership with ISDA, ISLA and ICMA for Standardizing Financial Products and Workflows, FINOS, February 16, 2023, [www.finos.org/press/finos-launches-common-domain-model-project-in-partnership-with-isdaisla-and-icma](http://www.finos.org/press/finos-launches-common-domain-model-project-in-partnership-with-isdaisla-and-icma)

<sup>4</sup> Timely Confirmations in OTC Derivatives: A Herculean Task?, Tradeweb, September 9, 2014, [www.tradeweb.com/newsroom/media-center/insights/blog/timely-confirmations-in-otc-derivatives-a-herculean-task](http://www.tradeweb.com/newsroom/media-center/insights/blog/timely-confirmations-in-otc-derivatives-a-herculean-task)

<sup>5</sup> Process Automation Comes to ISDA Master Agreements, Indico Data, May 22, 2020, [indicodata.ai/blog/process-automation-comes-to-a-tricky-financial-document-isdas-master-agreements/](http://indicodata.ai/blog/process-automation-comes-to-a-tricky-financial-document-isdas-master-agreements/)

<sup>6</sup> Generative AI vs. Traditional AI: Key Differences and Advantages, Artificial Intelligence Board of America, October 19, 2023, [www.artiba.org/blog/generative-ai-vs-traditional-ai-key-differences-and-advantages#:~:text=Generative%20AI%20learns%20from%20existing,for%20training%20or%20supervised%20learning.&text=Generative%20AI%20is%20used%20to,make%20decisions%2C%20and%20automate%20tasks](http://www.artiba.org/blog/generative-ai-vs-traditional-ai-key-differences-and-advantages#:~:text=Generative%20AI%20learns%20from%20existing,for%20training%20or%20supervised%20learning.&text=Generative%20AI%20is%20used%20to,make%20decisions%2C%20and%20automate%20tasks)

Similarly, genAI could be used to respond to general queries from internal stakeholders and counsel on trade confirmations by leveraging its capabilities in natural language processing and understanding. Having been trained to understand the content and structure of the ISDA Master Agreement, ISDA product definitions and a market participant's trade confirmations, the genAI model can learn to identify the intent of the question, extract relevant information from the trade confirmation, documentation and definitions, before generating responses. The model would then be able to provide responses in natural, interpretable language to queries regarding trade terms, the parties' obligations and valuation or settlement mechanisms in the pertinent ISDA definitions, or similar set of definitions. The genAI model could also provide links to the relevant sections in the documentation (such as the digitized ISDA definitions in ISDA MyLibrary<sup>7</sup>, or the underlying ISDA Master Agreement digitally captured in ISDA Create<sup>8</sup>, where applicable).

### Regulatory Application

Increasing transparency in the OTC derivatives market has been a regulatory priority since the global financial crisis and the Group-of-20 (G-20) summit in Pittsburgh in September 2009 to reform OTC derivatives markets. The commitments made at that summit included the reporting of all OTC derivatives contracts to designated trade repositories.

While there is little doubt the introduction of such regulatory reporting requirements was necessary to provide regulators with greater transparency and a clearer view of the derivatives markets, questions have been raised over whether the tools required to effectively analyze the reported data have kept pace with the volume of data being provided by derivatives counterparties<sup>9</sup>.

Regulators have discussed the possibility of AI being used to promote regulatory compliance, including AI tools to detect anomalies in regulatory data. For example, the US Commodity Futures Trading Commission (CFTC) has developed an AI model to identify previously undetected data anomalies in exchange reported regulatory data. Other use cases have been identified in relation to surveillance and detecting instances of misconduct<sup>10</sup>.

In addition, there are sometimes significant delays in market participants adjusting to changes to regulatory reporting rules. These revisions can range from minor changes published in the form of Q&A guidance to more significant rewrites of the technical standards. Trade identifiers such as the unique product identifier<sup>11</sup> and the OTC derivatives international securities identification number are also a more fundamental element of regulatory reporting and are now a key component across jurisdictions, meaning the consistent generation and application of these identifiers is a fundamental part of regulatory reporting. With regulators requiring hundreds of data points to be reported per transaction, a complete and accurate understanding of the rules is essential.

<sup>7</sup> ISDA MyLibrary, [www.isda.org/mylibrary/](http://www.isda.org/mylibrary/)

<sup>8</sup> ISDA Create, [www.isda.org/isda-create/](http://www.isda.org/isda-create/)

<sup>9</sup> Hidden in Plain Sight? Derivatives Exposures, Regulatory Transparency and Trade Repositories, ISDA, October 10, 2023, [www.isda.org/2023/10/10/hidden-in-plain-sight-derivatives-exposures-regulatory-transparency-and-trade-repositories/](http://www.isda.org/2023/10/10/hidden-in-plain-sight-derivatives-exposures-regulatory-transparency-and-trade-repositories/)

<sup>10</sup> Keynote of Chairman Rostin Behnam at the 2023 US Treasury Market Conference, Commodity Futures Trading Commission (CFTC), November 16, 2023, [www.cftc.gov/PressRoom/SpeechesTestimony/opabehnam39](http://www.cftc.gov/PressRoom/SpeechesTestimony/opabehnam39)

<sup>11</sup> Technical Guidance: Harmonisation of the Unique Product Identifier, Committee on Payments and Market Infrastructures, International Organization of Securities Commissions, September 2017, [www.iosco.org/library/pubdocs/pdf/IOSCOPD580.pdf](http://www.iosco.org/library/pubdocs/pdf/IOSCOPD580.pdf)



It is imperative that the rules are interpreted and implemented consistently, particularly for jurisdictions that apply dual-sided reported (where both counterparties to a trade report the transaction, with the data within the two submissions expected to match), in order to provide regulators with a full and accurate picture of derivatives market activity. One challenge is that the same data points can be applied inconsistently across jurisdictions. Although the introduction of the critical data elements (CDE)<sup>12</sup> has led to more uniform adoption of reportable fields, it remains the case that each reporting jurisdiction must be treated separately as each has its own unique fields and reporting requirements.

GenAI could enhance regulatory compliance in several ways:

- At an overarching level, genAI can improve the overall comprehension of regulatory obligations for each jurisdiction. The resulting genAI output will enable market participants to analyze and understand the reporting requirements more precisely and within the broader regulatory ecosystem;
- GenAI could be used to monitor for changes to existing requirements and provide an initial assessment of the impact such changes will have on current requirements;
- GenAI can be applied at a global level to identify inconsistencies across jurisdictions as to how the same (or similar) requirements are written and implemented. The combined reporting requirements across the G-20 jurisdictions would run to thousands of pages of rules, technical standards and guidelines. While this is arguably too large to be fully reviewed and analyzed by a human, it could be achieved with genAI, thereby enabling market participants and regulators to more easily identify where reporting requirements differ between jurisdictions.

To improve the timeliness and accuracy with which regulatory reporting obligations are implemented, a genAI model could consume, process and interpret regulatory rules and guidance, providing a clearly defined set of requirements for market participants to review and apply across product types and jurisdictions. The power of such a genAI model will increase as the reporting rules and underlying data itself becomes ever more standardized through initiatives such as the CDE and CDM.

A model could also review the existing reporting process for errors or other issues. The genAI model could then recommend insights into both potential causes and fixes for anomalies. This should decrease the costs of regulatory compliance<sup>13</sup>.

## B. Application Development and Maintenance

The complexity of maintaining derivatives positions across the trade lifecycle and the associated post-trade processes creates significant reliance on the underlying software and market utilities. As such, there is a variety of genAI use cases within the derivatives market associated with application development: requirement gathering, functional code generation, testing scope recommendations, test automation, test optimization and non-functional/infrastructure requirements, including end-of-life updates and security support for open-source software.

<sup>12</sup> Harmonisation of critical OTC derivatives data elements (other than UTI and UPI): Revised CDE Technical Guidance – version 2, Regulatory Oversight Committee, September 2021, [www.lei.roc.org/publications/gjs/roc\\_20210922.pdf](http://www.lei.roc.org/publications/gjs/roc_20210922.pdf)

<sup>13</sup> Study of the Cost of Compliance with Supervisory Reporting Requirements, European Banking Authority, [www.eba.europa.eu/sites/default/files/document\\_library/Publications/Reports/2021/1013948/Study%20of%20the%20cost%20of%20compliance%20with%20supervisory%20reporting%20requirement.pdf](http://www.eba.europa.eu/sites/default/files/document_library/Publications/Reports/2021/1013948/Study%20of%20the%20cost%20of%20compliance%20with%20supervisory%20reporting%20requirement.pdf)

Even in their infancy, genAI models have been proven to expedite the software engineering process through applications such as GitHub Copilot. McKinsey & Company found software engineers that used genAI to support coding were 56% faster<sup>14</sup>.

Market vendors, utilities and third-party application providers can use genAI to improve manual processes in software design, build, testing and validation. Advances in such technology tools present an opportunity to solve many of the existing challenges in the consolidation and transformation of back-end processes<sup>15</sup>.

### Proposing Code Changes

With updates to regulatory reporting requirements across jurisdictions, as well as future updates to standardize confirmation definitions, master agreement standards, clearing house margin valuation methodologies, qualifying compression criteria or unified data structures (such as the CDM), the potential for genAI becomes even more important. A genAI intermediary layer or tool could interpret these publicly available updates and generate easily interpreted change documents and amendments to software requirements.

Following the requirement gathering process, a genAI 'co-pilot' could be integrated into developer consoles to improve software development. This would improve development productivity, particularly where unit testing and repetitive tasks are concerned<sup>16</sup>. GenAI could be leveraged to allow non-technical business users to interface with the outputs from a tool that could monitor and summarize the non-functional health of applications across different components. This would ensure that critical market infrastructure is compliant with legal, regulatory and security standards governed at the enterprise or industry level.

Constant, automated regression testing and logging of results would allow the genAI system to raise code 'defects' or enhancement opportunities via a workflow tool. These improvements could then be assigned to a product subject matter expert (SME), who would prioritize the issues for development. Once reviewed and approved by the relevant product development SMEs, these updates can be automatically implemented into existing systems with code proposals and associated unit test cases for development review.

The tracking of such code changes would also be far more sophisticated, and better reported internally for code coverage requirements. This improvement in traceability between application components and their functional changes would allow for more accurate recommendations to be made on regression risk, test case automation and optimization of end-to-end testing flows. These traditionally manual processes in software development are a partial cause of the long lead times associated with enhancing market infrastructure software. Realizing the automation gains offered by genAI could improve productivity by up to 30%<sup>17</sup>. This is relevant not only to mandated changes (confirmation, regulatory obligations and standard definition changes), but also when considering the software development effort required to implement the genAI integration use cases proposed in this paper.

<sup>14</sup> The economic potential of generative AI: The next productivity frontier, [www.mckinsey.com/capabilities/mckinsey-digital/our-insights/the-economic-potential-of-generative-ai-the-next-productivity-frontier](http://www.mckinsey.com/capabilities/mckinsey-digital/our-insights/the-economic-potential-of-generative-ai-the-next-productivity-frontier)

<sup>15</sup> Increasing Efficiency in Cleared Derivatives Post-trade Technology, Acuiti, June 17, 2021, [www.acuiti.io/increasing-efficiency-post-trade-technology/](http://www.acuiti.io/increasing-efficiency-post-trade-technology/)

<sup>16</sup> The startling power generative AI is bringing to software development, KPMG, [kpmg.com/us/en/articles/2023/generative-artificial-intelligence.html](http://kpmg.com/us/en/articles/2023/generative-artificial-intelligence.html)

<sup>17</sup> Generative AI and the software development lifecycle, Thoughtworks, September 28, 2023, [www.thoughtworks.com/en-us/insights/articles/generative-ai-software-development-lifecycle-more-than-coding-assistance](http://www.thoughtworks.com/en-us/insights/articles/generative-ai-software-development-lifecycle-more-than-coding-assistance)

## C. Analysis and Insights

### Market Insights

One area where participants in the financial and derivatives markets could tap the potential of genAI is in generating market insights by synthesizing huge volumes of structured and unstructured data. GenAI can rapidly observe and analyze vast amounts of text-based information as well as raw, unstructured or semi-structured data<sup>18</sup>.

This allows genAI to offer new market insights to market participants. For example, if a sudden global event impacts markets around the world, genAI can quickly and comprehensively analyze all news reports and social media posts about that event in every language and format – something even a large team of human traders would not be capable of doing within a short period of time. Prior to the advent of genAI, human traders simply did not have the time or resources to consider the amount of data associated with certain market events. This output from genAI can be used by traders and investors to gauge market sentiment, assess market sentiment trends and adjust their trading strategies accordingly.

The immense analytical powers of genAI are not limited to text-based data, but also extend to audio and visual data. For example, it is well known that the statements and meeting minutes of the Federal Reserve System's Federal Open Market Committee (FOMC) move markets around the world<sup>19</sup>. Besides simply analyzing the textual content of the FOMC's communications, genAI can analyze non-textual information such as the tone, speech pattern and body language of FOMC officials, and compare them with past behavior to gain additional insights about the non-verbal signals being communicated by FOMC members<sup>20</sup>. These additional insights could provide a more nuanced understanding of FOMC communications, thereby influencing yield movements in ways that traditional text/numbers-only data analysis cannot.

Another example is large language models (LLMs) used by central banks to summarize interviews with entrepreneurs, economists and market experts and to generate a time series of their sentiments as a factor in making predictions of gross domestic product (GDP).

As such, genAI holds significant promise for providing valuable market insights in the derivatives industry. By analyzing vast amounts of historical and real-time market data, genAI can uncover patterns, trends, and correlations that may not be readily apparent to human analysts. This capability enables market participants, including traders, asset managers and risk managers, to make more informed decisions, optimize trading strategies and effectively mitigate risks.

One application of genAI for market insights in derivatives trading is the generation of predictive models. GenAI algorithms can analyze historical market data, including price movements, trading volumes and volatility patterns, to develop predictive models that forecast future market trends with a high degree of accuracy. These predictive models can help traders to identify profitable trading opportunities, anticipate market movements and adjust their trading strategies accordingly.

<sup>18</sup> Generative artificial intelligence in finance, OECD, December 15, 2023, [www.oecd.org/publications/generative-artificial-intelligence-in-finance-ac7149cc-en.htm](https://www.oecd.org/publications/generative-artificial-intelligence-in-finance-ac7149cc-en.htm)

<sup>19</sup> Measuring Central Bank Communication: an Automated Approach with Application to FOMC Statements, David Lucca and Francesco Trebbi, National Bureau of Economic Research, September 2009, [www.nber.org/system/files/working\\_papers/w15367/w15367.pdf](https://www.nber.org/system/files/working_papers/w15367/w15367.pdf)

<sup>20</sup> Artificial Intelligence in central banking, Douglas Araujo, Sebastian Doerr, Leonardo Gambacorta, Bruno Tissot, Bank for International Settlements Bulletin No 84, January 23, 2024, [www.bis.org/publ/bisbull84.htm](https://www.bis.org/publ/bisbull84.htm)

GenAI also has the ability to forecast market trends, volatility and correlations for various asset classes, including derivatives. By analyzing historical market data and identifying patterns and trends, genAI algorithms can generate forecasts that help investors anticipate market movements and adjust their investment strategies accordingly.

Furthermore, genAI can be used to conduct scenario analysis and stress testing of derivatives portfolios, identifying potential risks within derivatives portfolios via analysis of historical market data and risk factors. By predicting the likelihood of adverse events and simulating various market scenarios and their potential impact, genAI can help risk managers to optimize risk management strategies, allocate capital more efficiently and hedge against potential risks more effectively. This information can help risk managers and portfolio managers to better understand the risks inherent in their derivatives portfolios and take proactive measures to mitigate these risks.

In addition, genAI can provide valuable market insights for derivatives product development. Analyzing market data and investor preferences would enable the identification of emerging trends and opportunities for new derivatives products. By better understanding market demands and investor behavior, financial institutions can develop more innovative derivatives products that meet the evolving needs of market participants and capitalize on new market opportunities.

#### Analysis and Testing of Strategies

Given its ability to analyze data, genAI offers the potential to enhance quantitative trading strategies, mitigate the effects of a large trade on market fluctuations, as well as achieve operational efficiencies in trading systems.

Some studies have proposed a framework to use genAI to synthesize various market agents (participants) to simulate realistic market microstructures<sup>21</sup>. An advantage of this kind of multi-agent approach is to capture responses from the market to incremental trades. The agent-based environment helps traders conduct back-testing, evaluate their trading strategies and ensure they refine and optimize their algorithms before implementation by generating appropriate scenarios. It can also be used to assess the potential impact of a trade on the market before execution, especially in illiquid markets where even a small trade can lead to significant price movements.

Another example is to use genAI to create a time series of stress scenarios. As Jean-Noël Ardouin notes<sup>22</sup>, some research papers<sup>23</sup> imply that genAI-based regulatory metrics (eg, value-at-risk, expected shortfall) can provide accurate tail risk estimates. However, official adoption of genAI-based estimates into regulatory metrics and models is challenging, due to the lack of the transparency in the models.

#### Institutional Risk Profiling

Risk profiling is a tool financial institutions use to manage risk. Institutional risk profiling involves the capture and processing of large volumes of internal, cross-product institutional data to profile and generate responses to certain risk events. Risk profiles that are created through institutional risk profiling can be used to manage risks by informing compliance and oversight as well as contingency plans for unforeseen circumstances.

<sup>21</sup> Towards Realistic Market Simulations: a Generative Adversarial Networks Approach, Andrea Coletta, Matteo Prata, Michele Conti, Emanuele Mercanti, Novella Bartolini, Aymeric Moulin, Svitlana Vyetenko, Tucker Black, November 2021, [dl.acm.org/doi/pdf/10.1145/3490354.3494411](https://dl.acm.org/doi/pdf/10.1145/3490354.3494411)

<sup>22</sup> Leading the AI revolution: tangible opportunities in risk management, Jean-Noël Ardouin, September 4, 2023, [www.ey.com/en\\_ch/banking-capital-markets/leading-the-ai-revolution-tangible-opportunities-in-risk-managem](https://www.ey.com/en_ch/banking-capital-markets/leading-the-ai-revolution-tangible-opportunities-in-risk-managem)

<sup>23</sup> Limit Order Book Simulation with Generative Adversarial Networks, Rama Cont, Michai Cucuringu, Jonathan Kochems, Felix Prenzel, July 24, 2023, [papers.ssrn.com/sol3/papers.cfm?abstract\\_id=4512356](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4512356)

Global systemically important banks and other large financial institutions may not be well equipped to deal with certain risk events such as the UK gilt crisis<sup>24</sup> and the sharp increase in global interest rates in response to rising inflation and international conflict. A core reason for this is that such institutions may be unable to generate meaningful risk profiles from their internal data sets. Derivatives form a substantial part of global banking and capital markets and the contracts supporting the business can run to tens of thousands for the largest institutions<sup>25</sup>.

Individual contracts, including ISDA Master Agreements and associated collateral documentation, contain hundreds of data points<sup>26</sup>. When captured and aggregated at institutional level, this data can provide meaningful insights into a financial institution's susceptibility to a given market or institutional risk event, allowing safe and efficient responses to be generated.

At present, even though the automation of operational processes such as data capture has been a traditional use case for AI systems for several years<sup>27</sup>, institution-wide data is often not understood or captured in a meaningful way, even within the largest global financial institutions. Manual data extractions conducted by large teams of data analysts and inaccurate automatic data reading programs are yielding sub-optimal results in the ability of financial institutions to accurately understand and manage their risk<sup>28</sup>.

One near-term solution to this problem is the development and implementation of enterprise-level genAI systems. By nature, these are trained and developed using synthetic or internal data, which may alleviate a significant concern around the risks associated with the disclosure of proprietary data outside the institution.

Enterprise-level genAI systems can be used to capture data within an organization, and generate risk responses arising from large internal data sets. This might include documentation terms such as those from an ISDA Master Agreement and credit support annex. The use of synthetic or internal data also reduces cost, while application programming interfaces (APIs) can bridge gaps across a range of internal systems and data repositories.

#### Counterparty Credit Risk Management

Counterparty credit risk refers to the risk that a derivatives counterparty might fail to fulfil its contractual obligations (ie, it might default) prior to the final settlement of a derivatives transaction's cashflows. Counterparty credit risk consists of the exposure a market participant has to a counterparty and the credit quality of that counterparty, both of which are subject to market conditions.

<sup>24</sup> The UK gilt crisis occurred in September 2022 when 30-year UK gilt yields increased by more than 1.60 percent in less than three days. The crisis exposed structural flaws in the UK pension system and showed that pension funds can have a significant impact on financial stability. Gilts are bonds issued by the UK government, which are generally considered safe investments. They are named 'gilt' because the original bonds were issued with gold edges, hence the term 'gilt-edged securities'

<sup>25</sup> The Lehman Brothers Bankruptcy F: Introduction to the ISDA Master Agreement, Christan McNamara, Andrew Metrick, Journal of Financial Crises, 2019, [elischolar.library.yale.edu/cgi/viewcontent.cgi?article=1005&context=journal-of-financial-crises](https://elischolar.library.yale.edu/cgi/viewcontent.cgi?article=1005&context=journal-of-financial-crises)

<sup>26</sup> What is the ISDA Clause Library?, [www.isda.org/a/YiqTE/ISDA-Clause-Library-Factsheet.pdf](https://www.isda.org/a/YiqTE/ISDA-Clause-Library-Factsheet.pdf)

<sup>27</sup> Page 5, Generative AI is all the rage, Deloitte AI Institute, [www2.deloitte.com/content/dam/Deloitte/us/Documents/deloitte-analytics/us-ai-institute-gen-ai-for-enterprises.pdf](https://www2.deloitte.com/content/dam/Deloitte/us/Documents/deloitte-analytics/us-ai-institute-gen-ai-for-enterprises.pdf)

<sup>28</sup> Page 16, 2022 Report on Quality and Use of Transaction Data, European Securities and Markets Authority, April 19, 2023, [www.esma.europa.eu/sites/default/files/2023-04/ESMA74-427-719\\_2022\\_Report\\_on\\_Quality\\_and\\_Use\\_of\\_Transaction\\_Data.pdf](https://www.esma.europa.eu/sites/default/files/2023-04/ESMA74-427-719_2022_Report_on_Quality_and_Use_of_Transaction_Data.pdf)

If a counterparty fails to fulfil its contractual obligations prior to final settlement, the non-defaulting party will have to consider a replacement transaction(s): so-called replacement risk. The non-defaulting counterparty then has the risk it cannot replace the failed transaction with a replacement transaction that is sufficiently like the original transaction. It will also incur costs for obtaining a replacement transaction in the first place. Because the market value of derivatives transactions may vary during the life of the transaction, counterparty credit risk and replacement risk are bilateral risks of loss that are faced by both parties to a transaction.

Counterparty credit risk management requires a combination of risk management techniques and market insights, including credit, market and operational risk management, so the potential applications of genAI to counterparty credit risk management are wide-ranging.

Use of genAI in counterparty credit risk management is currently still in its infancy<sup>29</sup>. There may be additional value in applying a genAI solution in connection with counterparty credit risk management, where value-at-risk calculations and stress testing scenarios are concerned. The requirement here is that the creditworthiness indication is made at a high level of confidence, and that predictions of market movements are accurate and broad in terms of the time horizon.

Financial entities may be able to set an overall risk tolerance, counterparty-specific risk tolerances or trader-specific risk tolerances and genAI may be able to enforce the agreed upon tolerance limits while producing real-time reports of risk levels to management and/or board level, to the extent necessary. Such reports may even address the weaknesses or limitations of the calculations, or other circumstances that may influence their accuracy and reliability<sup>30</sup>.

Early warning signs and probabilities of default could be predicted based on all public information relating to a counterparty, including newly circulating news articles. Finally, genAI could be used to provide instant real-time calculations of replacement risk based on current market prices or replacement rates. Such models take into consideration a set of economic and financial factors, and in accordance with the hedging rules pre-set in the system, such models could provide various hedging suggestions. With the help of such models, the hedger may have a systematic and discretionary analysis of certain risk factors such as country risk.

## D. Operational Efficiencies

In addition to the analytical, documentation and development efficiencies, certain operational efficiencies can also be realized by genAI – in particular, firms' management of margin and their use of synthetic data.

### Margin

A ChatGPT plugin could be embedded into a central counterparty (CCP) margin simulator, connecting through an API to support users querying the results of their margin requirements. The CCP's margin calculator will perform the heavy lifting with respect to calculating the margin, and the ChatGPT plugin could be used as an interface for users to communicate in their natural language via prompts. The user experience could be improved as interaction with the margin simulator would be intuitive and interactive. This could decrease the skills and knowledge barrier of using a CCP's margin simulator and improve the efficiency of a firm's collateral management practices.

<sup>29</sup> How Generative AI Will Disrupt Credit Risk Modeling, Marco Folpmers, Garp, September 1, 2023, [www.garp.org/risk-intelligence/credit/generative-ai-risk-090123](http://www.garp.org/risk-intelligence/credit/generative-ai-risk-090123)

<sup>30</sup> How Generative AI Will Disrupt Credit Risk Modeling, [www.garp.org/risk-intelligence/credit/generative-ai-risk-090123](http://www.garp.org/risk-intelligence/credit/generative-ai-risk-090123)



### Use of Synthetic Data

In situations in which part of the market data is missing or unreliable, genAI excels at complementing and interpolating synthetic data. Synthetic data is quasi-data generated by genAI that captures, among other things, the empirical characteristics of real data. In particular, genAI outperforms humans in assessing verbal/categorical data.

It has been suggested that sharing financial data across institutions could contribute to global GDP growth<sup>31</sup>. However, sharing data across institutions presents many regulatory, security, privacy and other challenges. One alternative solution is to use synthetic data created by genAI, which offers deeper insights without giving rise to security or privacy concerns. The importance of synthetic data is further underlined in the context of retail banking, where access to real data is often restricted for confidentiality and regulatory reasons<sup>32</sup>.

Some major banks have already started using synthetic data to complement market execution data and for the purposes of detecting fraud and money laundering<sup>33</sup>. The use of synthetic data also fosters collaboration between financial institutions and academia, which can lead to enhancements in financial modelling without the confidentiality concerns associated with the use of real data.

Synthetic data may be used for the training of AI-machine learning and for testing model robustness<sup>34</sup>. By using limited real data, and with the help of manual adjustment, such algorithms can create large quantities of synthetic data at much lower cost than obtaining real data of the same quality. Some research even concludes that, in certain areas, genAI trained by using synthetic data may produce a more satisfactory outcome than using real data<sup>35</sup>.

Nevertheless, the quality of synthetic data is still of concern because some online information is already generated by AI, and therefore synthetic data generated upon such data – essentially synthetic data based on synthetic data – may lead to further flaws in the behavior of genAI.

GenAI has the potential to significantly expand the horizons for the use of synthetic data in the financial sector<sup>36</sup>. Algorithm-created synthetic data has advantages in mitigating imbalances and biases in real data, and algorithms can mimic thousands of similar scenarios based on limited real cases. By leveraging trustworthy financial data, genAI may produce a large quantity of relevant and usable synthetic data. Through the application of this data, market participants can more easily customize their AI training for specific functions, such as counterparty credit risk profiling.

<sup>31</sup> Financial data unbound: The value of open data for individuals and institutions, Olivia White, Anu Madgavkar, Zac Townsend, James Manyika, Tunde Olanrewaju, Tawanda Sibanda, Scott Kaufman, McKinsey Global Institute, June 2021, [www.mckinsey.com.br/~media/mckinsey/industries/financial%20services/our%20insights/financial%20data%20unbound%20the%20value%20of%20open%20data%20for%20individuals%20and%20institutions/financial-data-unbound-discussion-paper-june-2021.pdf](http://www.mckinsey.com.br/~media/mckinsey/industries/financial%20services/our%20insights/financial%20data%20unbound%20the%20value%20of%20open%20data%20for%20individuals%20and%20institutions/financial-data-unbound-discussion-paper-june-2021.pdf)

<sup>32</sup> Generating synthetic data in finance: opportunities, challenges, and pitfalls, Samuel Assefa, Daniel Dervovic, Mahmoud Mahfouz, Tucker Balch, Prashant Reddy, Manuela Veloso, JP Morgan, October 2020, [www.jpmorgan.com/content/dam/jpm/cib/complex/content/technology/ai-research-publications/pdf-8.pdf](http://www.jpmorgan.com/content/dam/jpm/cib/complex/content/technology/ai-research-publications/pdf-8.pdf)

<sup>33</sup> Synthetic Data for Real Insights, JP Morgan, [www.jpmorgan.com/technology/technology-blog/synthetic-data-for-real-insights](http://www.jpmorgan.com/technology/technology-blog/synthetic-data-for-real-insights)

<sup>34</sup> Generative Artificial Intelligence in Finance: Risk Considerations, Ghiath Shabsigh, El Bachir Boukheroua, International Monetary Fund, August 22, 2023, [www.imf.org/en/Publications/fintech-notes/Issues/2023/08/18/Generative-Artificial-Intelligence-in-Finance-Risk-Considerations-537570](http://www.imf.org/en/Publications/fintech-notes/Issues/2023/08/18/Generative-Artificial-Intelligence-in-Finance-Risk-Considerations-537570)

<sup>35</sup> MimicGen: A Data Generation System for Scalable Robot Learning using Human Demonstrations, Ajay Mandlekar, Soroush Nasiriany, Bowen Wen, Iretiayo Akinola, Yashraj Narang, Linxi "Jim" Fan, Yuke Zhu, Dieter Fox, [mimicgen.github.io/](http://mimicgen.github.io/)

<sup>36</sup> Generative Artificial Intelligence in Finance: Risk Considerations, [www.imf.org/en/Publications/fintech-notes/Issues/2023/08/18/Generative-Artificial-Intelligence-in-Finance-Risk-Considerations-537570](http://www.imf.org/en/Publications/fintech-notes/Issues/2023/08/18/Generative-Artificial-Intelligence-in-Finance-Risk-Considerations-537570)

## E. Emerging and Developing Economies<sup>37</sup>

GenAI can also be used to support the development of safe and efficient derivatives markets in emerging and developing economies (EMDEs). As EMDEs mature in the coming decades, there will be a growing opportunity to develop the derivatives markets for the purposes of risk management, improving the liquidity of cash products and reducing the costs of funding cash products. EMDEs may also seek to reduce their reliance on foreign financial institutions for access to the global derivatives market. GenAI could be used to support and accelerate these developments.

Critical barriers to the development of derivatives markets in the EMDEs include:

- i.** Issues relating to the legal enforceability of close-out netting and collateral arrangements;
- ii.** Wholesale restrictions on the use of derivatives products;
- iii.** Absence of appropriate regulatory frameworks to govern the market;
- iv.** Lack of human capital caused by, among other things, a lack of access to training for derivatives products and related legal, regulatory and contractual issues;
- v.** Lack of market infrastructure and systems to trade derivatives products (such as IT systems, trade repositories and CCPs); and
- vi.** Potential for systemic risk in the local market.

GenAI could alleviate some of these barriers by:

- i.** Generating preliminary legal advice on any local law impediments to close-out netting and collateral exchange and preparing netting and collateral legislation;
- ii.** Generating suitability reports for local market participants, so that any blanket restrictions on derivatives trading can be limited to high-risk or unsophisticated market participants;
- iii.** Generating regulatory policies for derivatives markets based on international standards but tailored to the EMDE's economic and legal requirements (eg, CCP clearing may not be immediately appropriate in markets with limited liquidity for derivatives transactions);
- iv.** Provision of training and assistance (eg, through chat bots) to foster an understanding of derivatives products and the legal, regulatory and contractual framework surrounding them;
- v.** Generating reports identifying:
  - a. Key infrastructure and systems required to develop a local derivatives market (based on international practice but tailored to local requirements);
  - b. Key milestones and costs for the implementation of such systems; and
  - c. Areas where such systems could be developed, perhaps more cheaply, by local service providers.

<sup>37</sup> For a more in-depth analysis of the development of derivatives markets in emerging and developing economies: ISDA Survey on OTC Derivatives in Emerging and Developing Markets, ISDA, July 2023 [www.isda.org/a/qfoge/ISDA-Survey-on-OTC-Derivatives-in-Emerging-and-Developing-Markets.pdf](http://www.isda.org/a/qfoge/ISDA-Survey-on-OTC-Derivatives-in-Emerging-and-Developing-Markets.pdf); Policy Framework for Safe and Efficient Derivatives Activity in Emerging and Developing Markets, ISDA, May 2022. [www.isda.org/a/YHVgE/Policy-Framework-for-Safe-andEfficient-Derivatives-Activity-in-Emerging-and-Developing-Markets.pdf](http://www.isda.org/a/YHVgE/Policy-Framework-for-Safe-andEfficient-Derivatives-Activity-in-Emerging-and-Developing-Markets.pdf)



- vi. Preparation of regulatory best practice policies and real-time reporting systems to effectively identify and manage systemic risk (eg, through trade reporting and related regulatory oversight) and market volatility (eg, with respect to foreign currency movements, which can be of particular concern for EMDEs with limited hard currency reserves).

While the risks relating to genAI identified in this paper apply equally in the context of EMDEs, these economies will also need to undertake risk assessments based on local market conditions. For example, the risk of data collected by genAI systems and the genAI systems themselves being compromised by cyberattacks may be of particular concern for EMDEs where market participants often do not have appropriate cyber security systems in place.

In conclusion, genAI could have an important role to play in accelerating the development of derivatives markets in EMDEs. GenAI could provide services that might not be available in the local market or that might be prohibitively expensive. For example, genAI could be used to simplify and accelerate the introduction of trade reporting rules, as well as to enable market participants to implement the requirements more efficiently and accurately. However, the use of genAI for such purposes will need to be considered on a case-by-case basis in line with its suitability for each EMDE.

## REGIONAL REGULATORY ISSUES

As the use of genAI increases, government and regulatory agencies are urgently exploring their roles in its regulation, including in financial markets. The regulations will have a significant impact on the implementation and use of genAI among firms.

### United States

In October 2022, the White House Office of Science and Technology Policy (OSTP) released the Blueprint for an AI Bill of Rights, a framework for how government, citizens, technology companies and other stakeholders can use AI (referred to as 'automated systems') in a responsible and accountable manner<sup>38</sup>. The OSTP proposed five principles<sup>39</sup> and associated practices to guide the use and design of AI systems and, although not legislation or binding US government policy, this may serve as a useful basis for future AI legislation generally, and for derivatives regulation specifically. In addition to the five principles, the OSTP contains sections covering the rationale for each principle and means of applying each principle in practice.

The publication of the OSTP demonstrates the US federal government's acknowledgement of the opportunities and challenges presented by AI technologies, striking a balance between fostering innovation and managing potential risks to citizens.

On January 25, 2024, in a move that shows its growing interest in AI in the derivatives markets and may be a precursor to AI-specific regulation in US derivatives markets, the CFTC published a request for comment (RFC) on the use of AI in markets regulated by the CFTC<sup>40</sup>. CFTC staff acknowledged that entities regulated by the CFTC, including swap dealers, major swap participants, swap execution facilities, designated clearing organizations and commodity pool operators, are increasingly exploring the use of AI and related technologies. CFTC staff also stated that the RFC is part of a broader effort to monitor the adoption of AI, including machine learning, in CFTC regulation. The CFTC's growing interest in the application of AI by regulated entities and in regulated markets indicates a recognition of the transformative potential and associated challenges of AI in financial markets.

This engagement signals a regulatory intention to understand the implications of AI and to seek input from industry participants, experts and stakeholders. It suggests the CFTC is laying the groundwork for informed and responsive regulation in collaboration with firms and individuals that would be most affected by such regulation.

### European Union

The EU's efforts are a good example of how complex and lengthy the regulation of genAI may prove to be, as it first proposed to regulate AI in 2021. As of March 2024, the regulation had not yet been finalized.

The EU AI Act<sup>41</sup> does not need to be individually implemented and will automatically bind all member states. This may be a good first step towards implementing a global regulatory framework for AI.

<sup>38</sup> Blueprint for an AI Bill of Rights: Making Automated Systems Work for the American People, The White House, [www.whitehouse.gov/ostp/ai-bill-of-rights/](https://www.whitehouse.gov/ostp/ai-bill-of-rights/)

<sup>39</sup> Five principles proposed by the White House OSTP: 1. Safe and effective systems; 2. Algorithmic discrimination practices; 3. Data privacy; 4. Notice and explanation; 5. Human alternatives, consideration, and fallback

<sup>40</sup> CFTC Staff Releases Request for Comment on the Use of Artificial Intelligence In CFTC-Regulated Markets, CFTC, January 25, 2024, [www.cftc.gov/PressRoom/PressReleases/8853-24](https://www.cftc.gov/PressRoom/PressReleases/8853-24)

<sup>41</sup> EU AI Act: first regulation on artificial intelligence, European Parliament, 2023, [www.europarl.europa.eu/topics/en/article/20230601STO93804/eu-ai-act-first-regulation-on-artificial-intelligence](https://www.europarl.europa.eu/topics/en/article/20230601STO93804/eu-ai-act-first-regulation-on-artificial-intelligence)

The EU AI Act will categorize AI systems according to their potential misuse, with higher risk models having to comply with stricter rules<sup>42</sup>. All high-risk AI applications will be assessed before their deployment and over their lifespan. AI providers will have to comply with certain obligations, such as reporting serious incidents to the European Commission and keeping their users aware that they are interacting with AI. The EU will also require human oversight of the AI model's outputs, technical documentation for software and detailed summaries of the data used for training<sup>43</sup>.

A provisional agreement on the EU AI Act was reached in December 2023<sup>44</sup>. As of March 2024, the accepted document was awaiting adoption by the European Parliament and the Council of the EU. Only after adoption will it become binding in EU law. Though the act does not address the OTC derivatives market specifically, once it is ratified, the law will apply to financial institutions conducting business in the EU.

None of the three main EU institutions (the European Commission, European Parliament and Council of the EU) has publicly addressed the use of genAI in the derivatives market, nor has there been any proposal to amend the European Market Infrastructure Regulation (EMIR) in response to recent developments. Market participants should perform exhaustive prudential checks on potential genAI tools to ensure they will not breach any applicable laws such as EMIR, the General Data Protection Regulation (GDPR) or, from January 2025, the Digital Operational Resilience Act. The derivatives industry will need to have a clear understanding of how to classify any of the AI models being used, as the act will treat those with a high-risk profile more strictly.

## United Kingdom

The UK is not intending to introduce new AI-specific legislation or an overarching AI regulator in the near term. The government published a whitepaper in March 2023<sup>45</sup>, setting out what it viewed as a flexible framework for AI regulation. This was underpinned by five broad cross-sectoral principles<sup>46</sup> and the expectation that existing UK regulators, including the Financial Conduct Authority (FCA) and the Prudential Regulation Authority (PRA), will take the lead in applying these principles to the risks in their respective sectors, while collaborating with each other, with the government and with businesses.

The Digital Regulation Co-operation Forum was formed as a central body, along with a multi-regulatory AI sandbox, aimed at ensuring consistent supervision and unified implementation of the guidance, and to avoid gaps. The objective of this UK approach was to be adaptable as the AI technology develops and to leverage rather than undermine existing regulations. The UK government has also emphasized its commitment to engaging internationally to support interoperability across different regulatory regimes.

<sup>42</sup> Artificial Intelligence Act: deal on comprehensive rules for trustworthy AI, European Parliament, December 12, 2023, [www.europarl.europa.eu/news/en/press-room/20231206IPR15699/artificial-intelligence-act-deal-on-comprehensive-rules-for-trustworthy-ai](http://www.europarl.europa.eu/news/en/press-room/20231206IPR15699/artificial-intelligence-act-deal-on-comprehensive-rules-for-trustworthy-ai)

<sup>43</sup> Proposal for a Regulation of the European Parliament and of the Council Laying Down Harmonised Rules on Artificial Intelligence (Artificial Intelligence Act) and Amending Certain Union Legislative Acts, [eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A52021PC0206](http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A52021PC0206)

<sup>44</sup> Artificial Intelligence Act: deal on comprehensive rules for trustworthy AI, [www.europarl.europa.eu/news/en/press-room/20231206IPR15699/artificial-intelligence-act-deal-on-comprehensive-rules-for-trustworthy-ai](http://www.europarl.europa.eu/news/en/press-room/20231206IPR15699/artificial-intelligence-act-deal-on-comprehensive-rules-for-trustworthy-ai)

<sup>45</sup> A pro-innovation approach to AI regulation, UK Government, August 3, 2023, [www.gov.uk/government/publications/ai-regulation-a-pro-innovation-approach/white-paper](http://www.gov.uk/government/publications/ai-regulation-a-pro-innovation-approach/white-paper)

<sup>46</sup> 1. Safety, security, robustness; 2. Appropriate transparency and explainability; 3. Fairness; 4. Accountability and governance; and 5. Contestability and redress

While the FCA and the PRA have opened a dialogue, sought industry engagement and published discussion papers on the impact of AI on financial markets, they have not yet proposed policies or signaled any potential regulatory proposals. Current indications are that the FCA believes its outcome-based approach and existing principles and frameworks will work to address many of the issues raised by AI in an adaptable and proportionate manner<sup>47</sup>, while highlighting the importance of ongoing industry engagement as AI technology develops.

Additionally, the FCA has reiterated its view that AI needs to be placed in a broader context, reinforcing the need for financial market participants to focus on operational resilience, outsourcing and third-party risk management. Further details should be forthcoming, as the UK government, in its response to the March 2023 whitepaper (published in February 2024 following a consultation period)<sup>48</sup>, directed UK regulators to publish their proposed strategic approach to AI by April 30, 2024.

## Canada

The Canadian government tabled the Artificial Intelligence and Data Act (AIDA) in June 2022, making it one of the first countries in the world to propose a law to regulate AI. In this respect, Canada aims to harmonize its approach with that of the EU, UK, and US.

The Canadian government recognizes that developments in AI have created regulatory gaps and provides the following examples<sup>49</sup>:

- Mechanisms such as human rights commissions provide for redress in cases of discrimination, but individuals subject to AI bias may never be aware that has occurred;
- Many sensitive use cases do not fall under existing sectoral regulators; and
- There is a need for minimum standards as well as greater coordination and expertise to ensure consistent protections for Canadians across use contexts.

Ultimately, the provisions of AIDA are not expected to come into force sooner than 2025.

AIDA would take a three-part approach<sup>50</sup>:

- (i)** Build on existing Canadian consumer protection and human rights law by ensuring high-impact AI systems meet the same expectations with respect to safety and human rights as existing legislation;
- (ii)** Ensure the relevant ministry is empowered to enforce the act to ensure policy and enforcement move together as the technology evolves. An office headed by a new AI and data commissioner would be created, starting with a role of education and assistance to also include compliance and enforcement; and

<sup>47</sup> Our emerging regulatory approach to Big Tech and Artificial Intelligence, Nikhil Rathi, Financial Conduct Authority, July 12, 2023, [www.fca.org.uk/news/speeches/our-emerging-regulatory-approach-big-tech-and-artificial-intelligence](https://www.fca.org.uk/news/speeches/our-emerging-regulatory-approach-big-tech-and-artificial-intelligence)

<sup>48</sup> A pro-innovation approach to AI regulation: government response, UK Government, February 6, 2024, [www.gov.uk/government/consultations/ai-regulation-a-pro-innovation-approach-policy-proposals/outcome/a-pro-innovation-approach-to-ai-regulation-government-response#fnref:28](https://www.gov.uk/government/consultations/ai-regulation-a-pro-innovation-approach-policy-proposals/outcome/a-pro-innovation-approach-to-ai-regulation-government-response#fnref:28)

<sup>49</sup> The Artificial Intelligence and Data Act (AIDA) – Companion document, Government of Canada, [ised-isde.canada.ca/site/innovation-bettercanada/en/artificial-intelligence-and-data-act-aida-companion-document](https://ised-isde.canada.ca/site/innovation-bettercanada/en/artificial-intelligence-and-data-act-aida-companion-document)

<sup>50</sup> The Artificial Intelligence and Data Act (AIDA) – Companion document, [ised-isde.canada.ca/site/innovation-bettercanada/en/artificial-intelligence-and-data-act-aida-companion-document](https://ised-isde.canada.ca/site/innovation-bettercanada/en/artificial-intelligence-and-data-act-aida-companion-document)

- (iii) Prohibiting reckless and malicious use of AI that may cause serious harm through the creation of new criminal law provisions.

The regulation of AI would be split among federal regulators – for banking and insurance – and provincial regulators for capital markets and derivatives markets.

Federally, the Office of the Superintendent of Financial Institutions, which is Canada's banking regulator, held a public consultation that closed on March 22, 2024, with final guidelines set to take effect on July 1, 2025. The guidelines are expected to recognize that the surge in AI and machine learning analytics increases the risk arising from the use of the models. The updated draft of the guidelines expressly includes AI and machine learning methods.

The expectation is that banks, insurers and pension plans will:

- (i) Adequately manage models at each stage of their lifecycle;
- (ii) Model risks to be managed proportionally to the organization's model risk profile, complexity and size; and
- (iii) Build out a well-defined enterprise-wide model risk management framework.

The guidelines will also address issues of model bias, fairness and privacy that could lead to reputational risk.

Provincially, the country's largest securities regulator, the Ontario Securities Commission, has published its initial report on the use of AI in Ontario's capital markets. It found that AI was used to enhance existing products rather than create new ones and was used to improve the efficiency and accuracy of operational processes and trade surveillance, and to support advisory and customer service.

There is currently no formal rule for market participants with respect to the use of AI technologies in Canadian capital markets<sup>51</sup>. In this respect, Canadian regulators have in the past taken note of how the US and EU/UK have approached regulation of the derivatives space and it is possible they will look to the US and Europe when drafting future regulation.

## Asia Pacific

Finally, it is important to recognize the progress being made in the Asia-Pacific (APAC) region. China has been particularly active in this space, not only within APAC, but on a global scale. Recently implemented legislation targeting genAI reflects China's efforts in this area. The Interim Measures for the Administration of Generative Artificial Intelligence Services came into effect in August 2023. The interim measures control how genAI services are provided in China, but more detailed legislation is expected to follow. In the meantime, individuals and companies must follow the interim measures, as well as other related regulation<sup>52</sup>.

<sup>51</sup> OSC publishes report on AI in the capital markets, Osler, November 13, 2023, [www.osler.com/en/blogs/risk/november-2023/osc-publishes-report-on-ai-in-the-capital-markets](https://www.osler.com/en/blogs/risk/november-2023/osc-publishes-report-on-ai-in-the-capital-markets)

<sup>52</sup> New Generative AI Measures in China, Ashurst, September 26, 2023, [www.ashurst.com/en/insights/new-generative-ai-measures-in-china/](https://www.ashurst.com/en/insights/new-generative-ai-measures-in-china/)

While other countries in the region may not have reached the same regulatory milestones, there is a noticeable effort underway, evidenced by the publication of reports and guidelines from the region. For example, the Association of Southeast Asian Nations (ASEAN) has published a 'Guide on AI Governance and Ethics'<sup>53</sup>, providing practical insights for organizations seeking to leverage AI technologies. This guide also includes recommendations for government entities to consider. In November 2023, the Monetary Authority of Singapore (MAS) also announced the successful conclusion of phase one of Project MindForge<sup>54</sup>, which seeks to develop a risk framework for the use of genAI in the financial sector.

Lastly, while Australia and New Zealand don't have AI-specific regulation, both countries are actively engaged in preparing regulatory frameworks to address the challenges and opportunities presented by AI technologies.

Following an AI-themed consultation in 2023, the federal government of Australia concluded that "existing laws likely do not adequately prevent AI-facilitated harms before they occur, and more work is needed to ensure there is an adequate response to harms after they occur"<sup>55</sup>.

Nevertheless, there is momentum towards addressing these challenges and the government's publication of a voluntary framework outlining AI ethics principles is a starting point<sup>56</sup>.

Indications from the New Zealand government suggest the Department of Internal Affairs is in the process of developing an AI framework<sup>57</sup>. Additionally, amendments to the New Zealand Privacy Act are expected, reflecting the government's acknowledgment of the importance of privacy in the AI era<sup>58</sup>.

<sup>53</sup> ASEAN Guide on AI Governance and Ethics, [asean.org/book/asean-guide-on-ai-governance-and-ethics/](https://asean.org/book/asean-guide-on-ai-governance-and-ethics/)

<sup>54</sup> Project MindForge was first announced by Heng Swee Keat, deputy prime minister and coordinating minister for economic policies, at the Point Zero Forum on June 26, 2023. Project MindForge looks into the risks and opportunities of genAI for the financial sector. It aims to develop a clear and concise framework on the responsible use of genAI in the financial industry, and to catalyze genAI-powered innovation to solve common industry wide challenges and enhance risk management. The project is supported by a consortium comprising DBS Bank, OCBC Bank, United Overseas Bank Limited, Standard Chartered Bank, Citi Singapore, HSBC, Google Cloud, Microsoft, MAS, Accenture, and the Association of Banks in Singapore

<sup>55</sup> Supporting responsible AI: discussion paper, Australian Government, June 1, 2023, [consult.industry.gov.au/supporting-responsible-ai](https://consult.industry.gov.au/supporting-responsible-ai)

<sup>56</sup> Australia's AI Ethics Principles, Australian Government, [www.industry.gov.au/publications/australias-artificial-intelligence-ethics-framework/australias-ai-ethics-principles](https://www.industry.gov.au/publications/australias-artificial-intelligence-ethics-framework/australias-ai-ethics-principles)

<sup>57</sup> "We need to get it right" – Government looking to get up to speed on AI regulation, January 29, 2024, [www.newstalkzb.co.nz/news/national/govt-turns-focus-to-ai-regulation/](https://www.newstalkzb.co.nz/news/national/govt-turns-focus-to-ai-regulation/)

<sup>58</sup> Why is regulating AI such a challenge?, Office of the Prime Minister's Chief Science Advisor, July 13, 2023, [www.pmcsa.ac.nz/2023/07/13/why-is-regulating-ai-such-a-challenge/](https://www.pmcsa.ac.nz/2023/07/13/why-is-regulating-ai-such-a-challenge/)

## CHALLENGES, RISKS AND BEST PRACTICES FOR GENERATIVE AI

GenAI requires large amounts of data to train models and generate outputs in response to user prompts. Processing such large volumes of data raises significant data and security concerns, especially in the financial services industry where financial, personal and proprietary data is essential in providing customer-centric solutions.

Model risks and ethical risks surrounding responsible use of genAI are also prevalent and require careful consideration. As such, it is important to develop best practices to help protect firms and customers facing data and security risks, model risks and ethical risks.

### A. Regulatory Risks and Best Practices

The use of genAI in the derivatives market presents a myriad of challenges, primarily revolving around regulatory compliance, ethical concerns and risk management. In the US, the CFTC and the Securities and Exchange Commission (SEC) have a significant role to play in overseeing and regulating derivatives markets. However, the rapid advances in genAI technology have outpaced existing regulatory frameworks, posing substantial challenges.

Globally, the integration of genAI in the derivatives market faces similar challenges and requires a comprehensive regulatory framework to address various concerns across jurisdictions. Divergence in regulatory approaches between different countries can add complexity to governing the use of genAI in financial and derivatives markets that are cross-border in nature.

In Europe, entities like the European Securities and Markets Authority and the European Banking Authority are working on harmonizing regulations to ensure consistency across EU member states. The EU's GDPR and emerging guidelines on AI ethics and accountability contribute to shaping regulatory discussions surrounding AI applications in finance. China, Japan and Singapore are actively exploring these frameworks. China, for instance, has its own set of guidelines and regulations for the use of genAI, balancing innovation with risk management. Japan and Singapore also have initiatives focusing on regulatory sandboxes and ethical guidelines to govern AI applications in financial markets. While each region may have its own specific regulatory nuances, establishing cross-border cooperation and adopting globally accepted principles can facilitate the development of a more cohesive regulatory framework for the responsible use of genAI in derivatives trading on a global scale.

One of the key challenges for participants in the derivatives market is the ambiguity surrounding the responsibility and accountability for the actions of AI-generated systems in trading derivatives. The lack of clear guidelines from regulatory bodies regarding the deployment of AI in trading activities raises questions about liability in case of system errors, market manipulation or unintended consequences. Without robust regulations addressing the use of AI in derivatives markets, there is a risk of disruption, exploitation of unfair advantage and even systemic risk.

From the perspective of regulators, the inherent complexity and opacity of genAI models make it challenging to effectively understand, monitor and control these systems<sup>59</sup>. GenAI models can autonomously learn and adapt, which may result in unpredictable behavior that could violate existing market regulations.

<sup>59</sup> Governing artificial intelligence: ethical, legal and technical opportunities and challenges, Corinne Cath, The Royal Society, October 15, 2018, [royalsocietypublishing.org/doi/10.1098/rsta.2018.0080](https://royalsocietypublishing.org/doi/10.1098/rsta.2018.0080)



Implementing best practices in this area requires collaboration between regulators, industry experts and AI developers to establish comprehensive guidelines and standards. Incorporating transparency into AI systems can enhance regulatory compliance, allowing for better oversight and understanding of these complex models. Initiatives to promote the ethical use of AI, such as the development of industry standards for responsible AI applications in finance, are crucial.

## B. Data and Security Risks and Best Practices

### Data Breaches

Publicly available open-source or open-access genAI is easily accessible to a variety of users, which makes adoption faster, but it also increases the risk of inadvertent data breaches. Publicly available genAI systems pose data breach risks because many of the public genAI systems automatically opt in users<sup>60</sup> and continuously use inputs from the users to train and fine-tune their models.

Users can enter any type of data into the genAI tool via open text boxes, including sensitive, private/personal data or proprietary/confidential information. Examples of sensitive financial data include confidential information relating to an individual's or organization's financial status, financial transactions, including the amounts, dates and parties involved, as well as other proprietary details. Once entered, the data becomes part of the genAI model and others using the publicly available genAI model can gain access to that data through prompts. The implication is that any confidential information, personally identifiable information, or other highly sensitive information that is entered into a publicly available genAI tool may be exposed to the risk of unintended disclosure to other users or the public at large. Several genAI providers acknowledge this specific risk and explicitly state in their terms and conditions of use that they cannot ensure the security and confidentiality of the information and data provided by users of the system.

Institutional versions of genAI allow users to better track and delete data from the information used to train and prompt a genAI model. However, institutional versions also have their own limitations and, at a minimum, require careful controls over those authorized to access and use that information to avoid potential data breaches. For example, to comply with various laws and regulations regarding data protection and privacy, such as GDPR, organizations may need to add processes such as obtaining explicit consent from data subjects and informing them of their rights and obligations prior to using certain data in genAI models. Given the black-box<sup>61</sup> nature of genAI models, it is very difficult to track the confidential data stored by the model, and to identify who has accessed it and how, or if, that confidential data can be removed from the model.

### Intellectual Property Loss or Infringement

Intellectual property (IP) loss and infringement by genAI systems can pose significant risks to creators and organizations that use generated outputs. IP loss or infringement can occur when ideas, inventions, creative works, logos, brand names and trade secrets<sup>62</sup> are used to train genAI models without the permission of the rights holders. For example, this may occur when a user enters confidential trade secret information into a genAI model; thereby making the information publicly available and potentially extinguishing the underlying rights in the trade secret. IP infringement may also occur when copyrighted material such as articles, images, code or music are used for model training without permission from the rights holders.

<sup>0</sup> Generative Artificial Intelligence in Finance: Risk Considerations, [www.imf.org/en/Publications/fintech-notes/Issues/2023/08/18/Generative-Artificial-Intelligence-in-Finance-Risk-Considerations-537570](http://www.imf.org/en/Publications/fintech-notes/Issues/2023/08/18/Generative-Artificial-Intelligence-in-Finance-Risk-Considerations-537570)

<sup>61</sup> 'Black box' is a term commonly understood to mean a system that produces results without the user being able to see or understand how it works

<sup>62</sup> Intellectual property and generative AI: Five IP risks for users and developers, Chris Baker, Deloitte, September 14, 2023, [www2.deloitte.com/uk/en/blog/ai-institute/2023/intellectual-property-and-generative-ai.html](http://www2.deloitte.com/uk/en/blog/ai-institute/2023/intellectual-property-and-generative-ai.html)



Once the copyrighted material is learned, the model can generate content based on the learnings and offer a substitute for the original copyrighted material. When the genAI model remembers information, it can produce near replicas of the original copyrighted material, which further diminishes the rights of the author. At times, the genAI model gives credit to the original author by citing the copyrighted material. However, citations may not be accurate and genAI models may fabricate content and wrongly attribute the content to certain authors, which can reflect poorly on the author<sup>63</sup>. Regardless of attribution, many authors have found that their copyrighted work was used to train genAI models without their permission and this may have resulted in IP infringement.

IP infringement can also occur when a person or company uses output generated by a genAI model and that output infringes another's IP. For example, a user may prompt a genAI model to create code. The data used to train the genAI model to generate the source code may contain proprietary code or open-source code with licensing restrictions. If the genAI generated source code is used without proper permissions having been secured, a user may face IP infringement risks. While work is being done to allow authors to opt out of having their content used to train genAI models, and to provide references to certain underlying content, these efforts do not eliminate the risks of IP loss or infringement.

#### Data Quality

Risks can arise when the data used to train and operate genAI models is inaccurate, incomplete, inconsistent or biased. This can result in the output being unreliable, misleading or harmful. For example, if data used to predict market movements or the creditworthiness of a counterparty is corrupted or manipulated, a genAI tool may produce erroneous or fraudulent results, leading to losses, reputational damage or legal liabilities. However, even good quality data can be misused if the genAI model evaluating that data lacks quality and integrity itself. The quality of the model stands with its ability to assess data without bias and appropriate parameters to weigh the importance of specific pieces of data. Additionally, limitations or blind spots of the tooling may be exploited.

#### Cyber Security

Another major risk of AI in the derivatives market is cyber security and privacy of the data and of the AI systems themselves. Financial institutions have access to large data sets that may include sensitive or personal information such as customer identities, financial transactions or confidential and proprietary information. This data is vulnerable to cyberattacks, data breaches and unauthorized access, which may compromise the confidentiality, integrity, trustworthiness, performance and availability of the data and AI systems.

Firms should be aware that threats may be both internal and external. For example, genAI can be exploited to generate more sophisticated phishing messages and emails or to present opportunities for malicious actors to impersonate individuals or organizations, leading to increased identity theft or fraud. The proliferation of deepfakes, resulting in more realistic videos, audios or images can inflict serious damage on both organizations and individuals<sup>64</sup>.

Without proper security, genAI may create new opportunities for cyberattacks with large impact. New forms of cyberattack include adversarial attacks that result in malicious attempts to manipulate or deceive the AI system used by a financial institution, its input or output leading to unpredictable behavior and false output.

<sup>63</sup> For example, see *New York Times Company v. Microsoft Corporation et al*, US District Court for the Southern District of New York, No. 23-11195

<sup>64</sup> Increasing Threat of Deepfake Identities, US Department of Homeland Security, [www.dhs.gov/sites/default/files/publications/increasing\\_threats\\_of\\_deepfake\\_identities\\_0.pdf](https://www.dhs.gov/sites/default/files/publications/increasing_threats_of_deepfake_identities_0.pdf)

Another new form of cyberattack is prompt injection, whereby malicious input is used to manipulate the model and cause it to take unintended actions. A further emerging form of cyberattack is training data poisoning, where a vulnerability is caused by tampering with the data or fine-tuning the genAI training data. This vulnerability may introduce unexpected consequences like bias, further vulnerabilities, or backdoors that can potentially compromise the model's security, effectiveness or behavior. External data sources increase such risks due to a lack of control and confidence in the data's authenticity and neutrality. These threats pose significant concerns for financial institutions and have the potential to increase contagion risk and systemic risk within the financial sector.

#### Potential Best Practices for Data and Security Risks

To mitigate data risks posed by genAI, financial institutions need to establish robust data governance frameworks and processes and to ensure that data used for genAI is of high quality, relevant and trustworthy. These processes should cover the entire data lifecycle – from data collection to disposal. Additionally, firms should validate and test the data and genAI models regularly to ensure they are fit for purpose, reliable, and unbiased. This may include monitoring and retaining generated output to track performance and identify design flaws or biases.

Data barriers and entitlements should be maintained in line with ethical walls within the organization. That would help to ensure the data is used only for the express purpose for which it was collected, and that it cannot be repurposed for use by departments that should not have had access to it. Consequently, any data subject to a non-disclosure agreement or that is otherwise subject to limitations (eg, specific personal information, third-party IP), should be easily identifiable to prevent it from being used as input. Appropriate consideration should also be given to the re-use of generated data and the use of generated data to train or fine-tune genAI models.

Security risks can threaten the integrity of the financial services industry and must be mitigated. To address these risks, financial institutions need to implement strong cybersecurity and privacy protection measures such as encryption, authentication, authorization, firewalls and backup systems. These measures should be implemented from the outset and follow best practices for security by design and privacy by design. Moreover, greater emphasis should be placed on conducting regular cybersecurity and privacy assessments to ensure data quality, data protection and security measures are followed and effective.

While organizations can implement structural data and security risk mitigation strategies, it is important that organizations recognize the best way to mitigate data and security risks is to train employees and create awareness of the risks. These trainings should also provide employees with appropriate guidance on using genAI systems and assessing the suitability of certain data for input into genAI models.

## C. Model Risks and Best Practices

### Model Risks

Traditional thinking on AI model risks should be extended to cover new classes of genAI model. Like traditional AI, genAI systems are based on at least one model. Typically, those models are tasked with predicting the likelihood that some unit of information (eg, text, pixel, audio) is likely to occur together with other pieces of similar information. For example, in the case of language, a LLM is typically tasked with predicting the probability that a token (ie, a syllable of a word) will occur after a given combination of other tokens. Given each such probability, in succession, the LLM can predict what text should come immediately and generate the text. The use of these models exposes organizations to traditional AI model risks.

However, in addition to traditional AI model risks, genAI creates the potential for renewed interest in at least the following areas of model risk:

- (i) When it comes to interpretability, a mainstay of traditional thinking has been to rely on sensitivity analyses – ie, does a model react the right way when one of its inputs, such as interest rates, moves in one direction? – and feature importance, identifying which of the inputs of a model are important in its predictions. These mainstays may need to be modified with genAI, due to the creation nature of the AI.
- (ii) Model complexity has reached new heights with genAI and simple methods like counting the number of parameters may prove misleading or lack usefulness. New ideas related to the ‘effective dimension’ of a model may prove relevant.
- (iii) The technological complexity of most genAI models is often equally unprecedented. For instance, many large models require clusters of graphical processing units to operate even for a single prediction, necessitating new thinking on the inherent risks of build vs. buy, even in the case of models.

The evolving nature of genAI means many model risks are still being identified. Therefore, to pinpoint what may be altogether new challenges and considerations for model risk, as opposed to older challenges or considerations recast in different terms, might pay dividends to organizations developing and using genAI. For instance, terms like ‘fine-tuning’ are re-castings of existing terminology and concepts (ie, ‘transfer learning’) and may not be the source of new risks. However, some risks are clearly new. Two important examples of new types of risks are founded on the fact that: (i) genAI relies on a generator; and (ii) these models can be optimized by choosing their inputs (eg, by ‘prompt engineering’ in the case of LLMs).

GenAI’s reliance on generators may create a potentially new type of model risk. A generator is at times an ignored layer that determines how the underlying model of a genAI system goes about generating content. For example, a ‘generator’ for an LLM could be a rule that says: select the highest probability next token, every time. These generators may suffer from hallucinations and create new types of model risks involving inaccurate outputs.

Model optimization, including prompt engineering, is another area that may pose a new type of model risk. As for tuning inputs/prompt engineering, the difficulty is that there is no current concrete mathematical theory describing what constitutes a tuning. This means there is no way to know whether a certain prompt, which seems to work in one context, may not have the opposite effect in another context. This uncertainty is caused, at least in part, because heuristics rather than optimizations are used to produce the prompts.

#### Potential Best Practices for Model Risk

Developing best practices to address model risk is important for the adoption and evolution of genAI in the financial services industry.

Some good practices to consider in this context include, firstly, the need to separate components. Organizations should be meticulous about pinpointing which component of a genAI system a risk belongs to. For example, in the case of LLMs, hallucinations are a feature of the generator rather than the underlying model.

A second practice is to decide what is new and what already exists. If a risk or challenge is present in a genAI system that is attributable to a component that has existed (in the previous era of AI), then one might look at how it was approached in the previous era before inventing a new framework. For example, there is a danger of underfitting when transfer learning is essentially a problem of degradation of an LLM's ability when fine-tuning.

A third practice is to be practical about interpretability. The scale of some of the models in genAI will mean the existing understanding of interpretability will have to become, in some cases, an aspirational rather than practical standard. Instead, to achieve standards close to the pre-genAI thinking on interpretability, innovation may be needed. Investing in such innovation may be worthwhile.

## D. Ethical Risks and Best Practices

### Bias and Discrimination

The use of genAI systems to assist with derivatives trading can pose numerous ethical issues. These warrant a closer examination of both the inputs and outputs of genAI systems and require appropriate consideration of best practices.

GenAI systems are only as effective as the data and scenarios used to train them. Unlike humans, they lack the judgment and context for many of the environments in which they are deployed<sup>65</sup>. GenAI algorithms may have inherent biases that can be learned from data or creep into the models through inherent designer biases. Poor data quality and improper training can limit the learning capability of genAI systems and negatively impact how underlying inferences and decisions are made. Input data can be discriminatory if it identifies or proxies class membership or causes protected class members to experience less favorable outcomes. Likewise, inadequate anonymization of input data may lead to biased outcomes<sup>66</sup>. Additionally, alternate systems and data sources may exist that can be used to generate better outcomes for disadvantaged groups.

Even if the data used to train a genAI model is of good quality, the generated output may result in biases or discrimination. Poor assessment of genAI outputs by humans, inadequate anonymization of generated output, and poor transparency into how results were achieved can have a discriminatory impact. It may be impossible to test and validate every scenario, permutation and combination of available data, which can result in output variations.

Discrimination is usually observed in three ways: overt discrimination, disparate treatment and disparate impact. Disparate treatment occurs when similarly situated individuals are treated differently on a prohibited basis, but treatment is not necessarily motivated by prejudice or intent to discriminate. In the genAI context, this could occur when a firm explicitly uses a protected class status in a genAI model to underwrite creditworthiness. Disparate impact occurs when a genAI model includes features that lead to disproportionately unfavorable outcomes for a protected class. These situations are assessed independently of the accuracy and validity of the genAI tool, and a system can be legally discriminatory even if it is statistically sound.

<sup>65</sup> Artificial Intelligence Risk & Governance, Wharton Faculty, University of Pennsylvania, [ai.wharton.upenn.edu/white-paper/artificial-intelligence-risk-governance/](https://ai.wharton.upenn.edu/white-paper/artificial-intelligence-risk-governance/)

<sup>66</sup> Data Ethics and the Use of AI/ML in Financial Services: How to mitigate risks, Tim Jennings, Synechron, [www.synechron.com/en-us/white-papers/data-ethics-and-use-ai/ml-financial-services-how-mitigate-risks](https://www.synechron.com/en-us/white-papers/data-ethics-and-use-ai/ml-financial-services-how-mitigate-risks)

### Trust, Transparency and Interpretability

GenAI systems can create ethical risks if they generate results that are unexplainable, unjustifiable and unreliable and affect the autonomy and rights of those targeted. As an emerging technology, the lack of general understanding can give rise to trust issues and a perception that genAI models are a black box that cannot easily be understood. GenAI models may also obfuscate the basis of key decisions. It is essential to the organizations overseeing these functions that any recommendations or decisions must be explainable. Data privacy issues can also result in mistrust of AI systems. Inadequate anonymization can lead to invasions of privacy, particularly if hackers breach the system. Additional difficulties arise when determining the intellectual property rights of AI outputs.

### Potential Best Practices for Ethical Risks

GenAI models are constantly evolving and persistent vigilance must be observed. To address the risks, this whitepaper recommends firms should implement the following best practices.

### Governance Framework

First, firms should adopt a genAI governance framework and ensure third-party suppliers adequately implement appropriate risk management and information security processes. Additionally, employees need to be educated on the risks of genAI, including how to watermark and disclose the use of genAI. Firms should ensure they provide their customers with labels and disclaimers so they are aware of when they are interacting with an AI system.

### Human-based Oversight and Action

GenAI systems can be used to treat people unfairly and reinforce existing societal biases<sup>67</sup>. Similarly, genAI assessments of regulatory requirements may ingest pre-existing poor data or bad information when performing such analysis, thereby perpetuating any substandard practices or inaccurate interpretations that are already in place within the market. In order to protect against these situations, genAI decision-making must be supplemented with sound human judgment and humans need to be held accountable for any final decisions made. Similarly, genAI needs to be reliable and safe when managing financial functions. This requires rigorous testing during system development and deployment, and consistent oversight and maintenance to protect the system over its lifespan.

GenAI designers and developers must understand and address potential barriers to inclusiveness in product development that could unintentionally exclude diverse perspectives. Further, genAI models must be traceable, meaning that goals, design choices, definitions and assumptions should be documented. The ability to communicate how the model was built and by whom, its technical behavior, and any limitations or potential inaccuracies, will help executives, boards, employees and customers to trust the model's predictions.

<sup>67</sup> Microsoft's perspective on responsible AI in Financial Services: An approach to help you build trusted and respected AI, Daragh Morrissey, Nick Lewins, Microsoft, [query.prod.cms.rt.microsoft.com/cms/api/am/binary/RE49D4I](https://query.prod.cms.rt.microsoft.com/cms/api/am/binary/RE49D4I)

## FUTURE OUTLOOK

As the global derivatives market continues to evolve in response to technological advances and changing market dynamics, genAI holds significant promise. The technology is advancing rapidly, driven by ongoing research and development efforts. Emerging trends include the integration of genAI with other advanced technologies such as blockchain, quantum computing and federated learning to enhance scalability, privacy and performance. Moreover, developments in explainable AI and interpretable machine learning techniques are enabling greater transparency and trust in genAI models, addressing concerns related to bias, fairness and accountability.

Additionally, the democratization of AI through open-source frameworks, cloud computing platforms and collaborative research initiatives is expanding access to genAI tools and resources, empowering organizations of all sizes to harness the power of AI for innovation and growth. Furthermore, the convergence of AI with domain-specific expertise and industry knowledge is driving the development of specialized genAI solutions tailored to the unique needs and challenges of the derivatives market.

### Potential Impact on the OTC Derivatives Market

The integration of genAI in the OTC derivatives market will have a transformative effect on market structure, trading and risk management practices. GenAI-powered trading algorithms and smart order routing systems are expected to enhance liquidity provision, reduce transaction costs and improve market efficiency by facilitating faster execution and price discovery. Moreover, AI-driven risk management models and predictive analytics tools will enable market participants to better understand and manage complex risks inherent in derivatives trading, leading to more resilient and stable markets.

The adoption of genAI for regulatory compliance and market surveillance purposes will enhance regulatory oversight, transparency and investor protection in the derivatives market. Regulators will be able to leverage AI-driven surveillance systems and risk assessment models to detect and prevent market abuse, fraud and systemic risks, ensuring the integrity and stability of financial markets. However, challenges relating to data privacy, cybersecurity and regulatory compliance will need to be addressed to realize the full potential of genAI in the derivatives market.

### Recommendations for Stakeholders and Decision-makers

In light of the evolving landscape shaped by genAI, stakeholders and decision-makers in the derivatives market are encouraged to embrace innovation, collaboration and continuous learning to remain competitive and resilient in the digital age.

Key recommendations include:

- Investing in talent development and upskilling initiatives to build AI capabilities and expertise within organizations;
- Fostering collaboration and knowledge sharing partnerships with technology providers, academia and regulatory bodies to drive innovation and best practices;
- Prioritizing ethical AI principles and responsible AI governance frameworks to mitigate risks relating to bias, fairness and transparency;

- Engaging with policymakers to promote an appropriate regulatory framework that fosters innovation while safeguarding market integrity and investor protection;
- Continuously monitoring emerging trends and developments in genAI to identify new opportunities and adapt strategies accordingly.

By adopting a proactive and collaborative approach to the adoption of genAI, stakeholders and decision-makers can position themselves to harness the transformative potential of AI in the derivatives market, driving growth, innovation and resilience in the years to come.

## CONCLUSION

This whitepaper has identified several use cases for genAI in the derivatives market, including efficiencies that can be gained in document creation and summation, data analysis, regulatory compliance, application development and operational efficiencies. However, such efficiencies come with a number of risks. Unintentional bias, regulatory issues relating to the use of AI, the risk of the AI models not being suitable, the IP and privacy concerns and the reputational risk of a failure caused by use of genAI are all substantial risks.

In addition, the absence of comprehensive AI regulation prevails globally and proposed regulations lack specificity for derivatives. Given the nascent state of regulation, the specific impact for derivatives industry participants is currently uncertain. However, various governments' efforts at establishing frameworks for the responsible use of AI offer a valuable foundation and contain principles and mechanisms that can inform and guide regulators as they consider how to effectively regulate the use of AI in derivatives markets.

As genAI's influence continues to deepen in the financial and derivatives markets, the proactive development of regulatory frameworks should serve as a blueprint for regulators seeking to address the challenges ahead. The groundwork laid today, with a focus on accountability and responsible practices, may hint at a future in which derivatives regulation not only accommodates but actively harnesses the potential of AI, fostering innovation while ensuring the stability and ethical use of genAI in these markets. No doubt the challenge, and hopefully the trajectory, of future AI regulation in the derivatives market will focus on ways to create an effective regulatory framework that anticipates and adapts to the evolving synergy between AI and derivatives.

In the near term, participants will need to navigate the use of genAI in the absence of any specific regulatory frameworks, and monitor for regulatory and legal updates. This whitepaper identifies certain concrete best practices that market participants can take proactively to alleviate the risks. Firms are encouraged to adopt a strong governance framework and adequate policies and procedures for their own and their third-party suppliers' use of genAI. In addition, firms are encouraged to ensure human actionability and oversight of genAI-generated content or decisions.

The adoption of genAI represents a transformative opportunity for the derivatives market to unlock new avenues for growth, innovation and resilience. However, there are significant risks that should be considered when adopting this technology. Market participants are encouraged to approach the technology thoughtfully and to ensure there is appropriate oversight and robust safeguards in place for its use. By embracing genAI-driven solutions and leveraging AI capabilities in a considered manner, stakeholders can navigate the evolving landscape with confidence, driving sustainable value creation and shaping the future of derivatives trading.



## APPENDIX

### List of Contributors

Firm	Name
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ByteDance	Baihui Li
Caisse De Dépôt Et Placement Du Québec	Sara Diboune
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Factor Law	Tom Reynolds
Federal Home Loan Mortgage Corporation (Freddie Mac)	Lizet Steele
Goldman Sachs	Dimitris Tsementzis
HOOPP   Healthcare of Ontario Pension Plan	Zhongfa Liao
HSBC	Katy Chiu
International Finance Corporation	Jiaqi (Jack) Liu
K&L Gates LLP	Matthew Rogers
King & Wood Mallesons	Andrew Fei
Latham & Watkins LLP	Naffie Lamin
Marex	Katherine Arden
Mayer Brown LLP	Robyn Llewellyn
Mizuho	Takuya Otani
Norton Rose Fulbright LLP	Sean Bruns
Osler, Hoskin & Harcourt LLP	Jasmyn Lee
OSTRA	Glenn Ng (Ng Hong Qing)
PwC	Sohei Ogino (Ogi)
Rabobank	Marc Droge
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Sullivan & Cromwell	Danielle Abada
TD Securities	Valentin Nichita
The Royal Bank of Canada	Keith Knopp
The Vanguard Group, Inc.	John Montgomery
The Vanguard Group, Inc.	Steve Kowalick
WestPac	Sylvia Lau
White & Case LLP	Phillan Amin
	Ola Wesolowska

## ABOUT THE IFLD

The ISDA Future Leaders in Derivatives (IFLD) program aims to make a positive impact on the future of the derivatives industry by identifying a diverse group of emerging leaders across the industry. The program has four core objectives: to create an active forum for networking and discussion of industry topics and future industry trends; to increase the demographic, cultural and professional diversity of senior leaders within the financial services sector; to support emerging leaders in developing soft skills and technical expertise; and to develop and produce content on issues of strategic importance to ISDA and its members. For more information on the IFLD program, please contact [IFLD@isda.org](mailto:IFLD@isda.org).

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## ABOUT ISDA

Since 1985, ISDA has worked to make the global derivatives markets safer and more efficient. Today, ISDA has over 1,000 member institutions from 77 countries. These members comprise a broad range of derivatives market participants, including corporations, investment managers, government and supranational entities, insurance companies, energy and commodities firms, and international and regional banks. In addition to market participants, members also include key components of the derivatives market infrastructure, such as exchanges, intermediaries, clearing houses and repositories, as well as law firms, accounting firms and other service providers. Information about ISDA and its activities is available on the Association's website: [www.isda.org](http://www.isda.org). Follow us on [Twitter](#), [LinkedIn](#), [Facebook](#) and [YouTube](#).