

Market infrastructures and market integrity: A post-crisis journey and a vision for the future



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1 INTRODUCTION

Exchanges and clearinghouses / central counterparties (CCPs), (hereinafter referred to collectively as market infrastructures, or MIs), serve two main functions:

1. Fostering economic growth by enabling the efficient allocation of capital, including providing access to capital (for issuers) and providing avenues for investment and risk management (for investors)
2. Supporting market integrity by (amongst others) strengthening systemic stability, ensuring adherence to transparency obligations by listed companies, and adherence to rules by market participants, and investors

The World Federation of Exchanges (WFE) and UNCTAD¹ published a report focusing on the first objective in September 2017, titled *The Role of Stock Exchanges in Fostering Economic Growth and Sustainable Development*.

This report focuses on the second purpose – the role of MIs in supporting market integrity. Market integrity is a cornerstone of fair and efficient markets, ensuring that participants enjoy equal access to markets, that price discovery and trading practices are fair, and that high standards of corporate governance are met. We have adopted a definition of market integrity that includes monitoring for market abuse and manipulative trading, while fostering non-discriminatory market access, price formation/transparency, strong disclosure standards, and investor protection. MIs play a pivotal role in supporting integrity: through overseeing listings, approving and supervising market participants, managing risk through CCPs, reporting data, and enforcing rules as defined by regulators and by MIs themselves.

The report presents:

1. How MIs have evolved since the 2008 global financial crisis in response to regulatory reform to promote safe and efficient markets (Chapter 2)
2. Trends in financial markets and their implications for MIs with respect to preserving market integrity (Chapter 3)
3. A vision for the future role and capabilities of MIs in ensuring market integrity (Chapter 4)

This report is a joint publication between Oliver Wyman and the WFE, and is aimed at policymakers, regulators, MI executives, and market participants. It has been informed by two surveys of WFE members covering the regulatory landscape and strategic perspectives, and interviews with senior executives across the industry. The report was guided by a Steering Committee comprised of senior executives from 12 WFE member exchanges and by the WFE Board which consists of Chairman and Chief Executive Officers of 18 MIs around the world.

We intend for this report to be read by stakeholders across the ecosystem. We emphasize the important role that MIs play in maintaining market integrity and explain how this role may evolve in response to key trends in the industry. We outline a vision for the future of market integrity that will increase confidence in financial markets and help MIs meet the changing expectations of their stakeholders. While we focus on MIs, we call on all stakeholders in the financial markets ecosystem – including regulators and policymakers – to work together in pursuit of this objective. We are confident that the industry will step up to the challenges and new demands placed upon them.

¹ United Nations Conference on Trade and Development

EXECUTIVE SUMMARY

The global financial crisis prompted governments and regulators to develop and implement wide-ranging regulatory reforms. Throughout this period, MIs have demonstrated a high degree of resilience, reemphasizing their instrumental role in ensuring financial market effectiveness and systemic stability globally.

Reform driven by the Group of 20 (G20) has aimed at increasing the transparency and robustness of financial markets, by shifting instruments towards exchange-traded and centrally cleared markets. At the same time, capital scarcity and new regulations have constrained the capacity for bank-based financial intermediation, thereby facilitating financial markets' growth. The number of on-exchange securities trades² and the number of derivatives contracts traded rose by more than 107 percent and 65 percent respectively between 2007 and 2017 according to WFE data. Furthermore, based on BIS data, we estimate that over the same period, the notional volume of contracts centrally cleared has risen by over 300 percent (given limited central clearing prior to 2008). MIs have also been transformed during this time: M&A activity has resulted in more vertically integrated business models, and regional firms have collaborated to create more horizontal business models.

The above changes have further increased the responsibility of MIs in ensuring market integrity. Their mandate has been extended to cover a broader range of services, along the full financial markets value chain. The risks have become more complex, driven by shifts in credit and liquidity risk management responsibilities. New non-financial risks, such as cyber risk as well as a broader set of market risks stemming from macroeconomic and geopolitical developments, further need to be accommodated. Lastly, new technologies such as artificial intelligence (AI) and the focus of market intermediaries on building digital capabilities accelerate the evolution of financial markets and the necessary MI supervision within them. Based on our survey of 30-plus WFE members, more than 70 percent believe that supervision requirements have increased over the past 10 years and will continue to increase in the coming decade.

Many of the trends that have shaped financial markets since the crisis will intensify in the near future. (See Exhibit 1.) These trends (namely changing stakeholder expectations and evolution of markets) will present new challenges for MIs in preserving market integrity, but also new opportunities to conduct supervision and surveillance more efficiently.

2 Securities refer to equities, ETFs, investment funds and securitized derivatives. Some historic data has been estimated based on trends in number of trades in securities over the ten year period

Exhibit 1: Overview of enhanced expectations of stakeholders and evolution of markets

ENHANCED EXPECTATIONS OF STAKEHOLDERS



REGULATORS AND POLICYMAKERS

- Increased mandate for types of securities to be traded on exchanges and centrally cleared
- Enhanced supervisory requirements (e.g. circuit breakers, disclosure standards, broker licensing)
- Upgraded risk management standards
- Scrutiny on benchmark calculation



ISSUERS

- Expansion in issuer type (e.g. SMEs, PE/VC-backed entities)



INVESTORS

- Institutional investors actively advocating for corporate governance principles
- Buy-side increasingly looking at costs and benefits of existing market structure
- Exchanges playing an important role in attracting foreign investments in markets



MARKET PARTICIPANTS

- Increased complexity driven by algorithmic trading and associated advances in data analysis
- Rise of passive investment strategies
- Changing nature of trading including an increase in automated algorithmic trading

CONTINUING EVOLUTION OF MARKETS



VENUES

- Proliferation of trading venues and emergence of new technology platforms
- Regulatory effort to ensure continued efficient price formation
- Additional effort needed to consolidate data, track venues, and ensure best execution



PRODUCTS

- Innovation to develop new products and platforms e.g. provision of electronic execution venues for bonds
- New risks of market abuse that must be addressed



TECHNOLOGIES

- Continued electrification of trading including algorithmic trading and robo advisory
- Adoption of new technologies including big data and distributed ledger technologies

MIIs will need to stay abreast of these dynamics and respond to these trends through changes to their operating models and practices and through investments in selected areas.

Over the next decade we anticipate that these trends will require five key shifts in how MIIs approach market integrity. (See Exhibit 2.)

Exhibit 2: Key shifts: a vision for the future

FROM	TO
1 Meeting the core market integrity standards Perceived low differentiation in market integrity outcomes across most markets	Higher standards of market integrity as competitive differentiator Well-defined measures of market integrity outcomes across venues enabling differentiation
2 Supervision as regulatory function Supervision focused on compliance with exchange rules/regulatory policies	Supervision as regulatory function + offerings that reduce industry-wide cost of compliance Potential for MI to support industry with a broader suite of regulatory and compliance solutions to reduce overall costs of compliance
3 Early stage cooperation Cooperation focused on policy input and event diagnostics	Broad industry cooperation Pro-active, on-going industry cooperation to enhance market integrity
4 Post fact surveillance Near-real time, pre-emptive approach to surveillance as best practice	Real-time surveillance Real-time, preventive surveillance as the standard and intensive use of AI
5 Rules and regulations based supervision Focus on defining policies and ensuring adherence to standards as primary approach	Interactive, outcome oriented supervision Focus on definition of standards and adherence to principles – enhancing ownership of compliance across supervised entities and increasing the interactions of market infrastructures with supervised entities

MIIs will have to adapt swiftly to execute on the above key shifts (Exhibit 2) while keeping pace with markets and competitors' innovations. The changes outlined above are not minor, and the rate of change and increasing prominence of these institutions requires a proactive, robust approach. We see MIIs stepping up in the following ways:

- Bold investments in new technologies (such as AI and pattern recognition) to support capabilities necessary for enhanced market integrity; one example of a new competency would be the development of (near) real-time monitoring enabling more rapid detection of market abuse
- Assumption of a leading role in providing opportunities to collaborate across MIIs, regulators and market participants to develop joint solutions to support market integrity, for example: centralized monitoring to assess activity across venues or cross CCP credit risk monitoring
- Increased focus on improving risk management and compliance frameworks, and the tools and digitization of core functions within these
- Continued enhancement of supervisory functions, including expanded mandates to teams and the creation of specialized groups that combine data analytics expertise and front-office experience

We expect MIIs and market participants collectively will need to make investments of up to US\$3–4 billion (with roughly 40 percent of this investment being undertaken by MIIs, some of which is underway) to realize the above agenda over the next five years; the reason to make this investment is to continue to improve market integrity.

While MIIs have evolved over the past decade to meet new regulatory, market, and stakeholder requirements, their development is ongoing, given transformations in technology and regulatory standards. And as a result of their central role in financial markets, they are positioned to lead the industry into the future.

2

THE EVOLVING SUPERVISORY ROLE OF MARKET INFRASTRUCTURE FIRMS

Market integrity is critical for efficient, well-functioning markets and includes a number of components³, namely:

- Clear, fair, and robust rules governing access and participation in markets, including the promotion of non-discriminatory market access
- Monitoring to minimize market abuse and manipulative trading methods
- Price transparency and price formation
- Strong disclosure standards
- Investor protection
- Orderly trading and systemic stability

MIs foster market integrity by exercising the following functions: rulemaking, member admission, market surveillance, market data and regulatory reporting, and investor education.

³ Janet Austin, "What Exactly is Market Integrity? An Analysis of one of the Core Objectives of Securities Regulation" (February 2017)

MIIs are, to a greater or lesser extent self-regulatory organizations (SROs) in as much as they define the rules of the market (often with approval by government regulators) and perform market supervision and oversight functions. Their functions are often grouped within a supervisory or self-regulatory function, sometimes run independently of the MI. The type of self-regulatory duties undertaken by each institution and how these are delivered, vary from one jurisdiction to another, depending on the domestic regulatory framework, levels of competition within a jurisdiction, strength of local regulators, and the maturity of the market.

The role of MIs in preserving market integrity has never been as important as it is today. Market developments (such as rate-rigging scandals and flash crashes), coupled with the global financial crisis (GFC) prompted regulatory reforms that resulted in MIs being both increasingly important players in addressing gaps in financial markets and the focus of greater regulatory scrutiny. Market participants see market integrity as a significant social benefit generated by MIs. (See Exhibit 3.)

The G20 fundamentally transformed financial markets to mitigate the risks prevailing at the time of the crisis and to modernize the regulatory architecture governing them. These reforms have seen a large shift of over-the-counter (OTC) trading volumes to more transparent exchange or exchange-like marketplaces, together with a shift towards CCP clearing for OTC securities, enhanced central reporting of trades, and enhanced capital, liquidity, and risk management standards. These developments have pushed markets to become more transparent and more effective in mitigating systemic risk. They have, however, also vastly increased the mandate of MIs. This is particularly true of CCPs, where risk is highly centralized across markets and thus requires significantly more focus on risk management and supervisory practices.

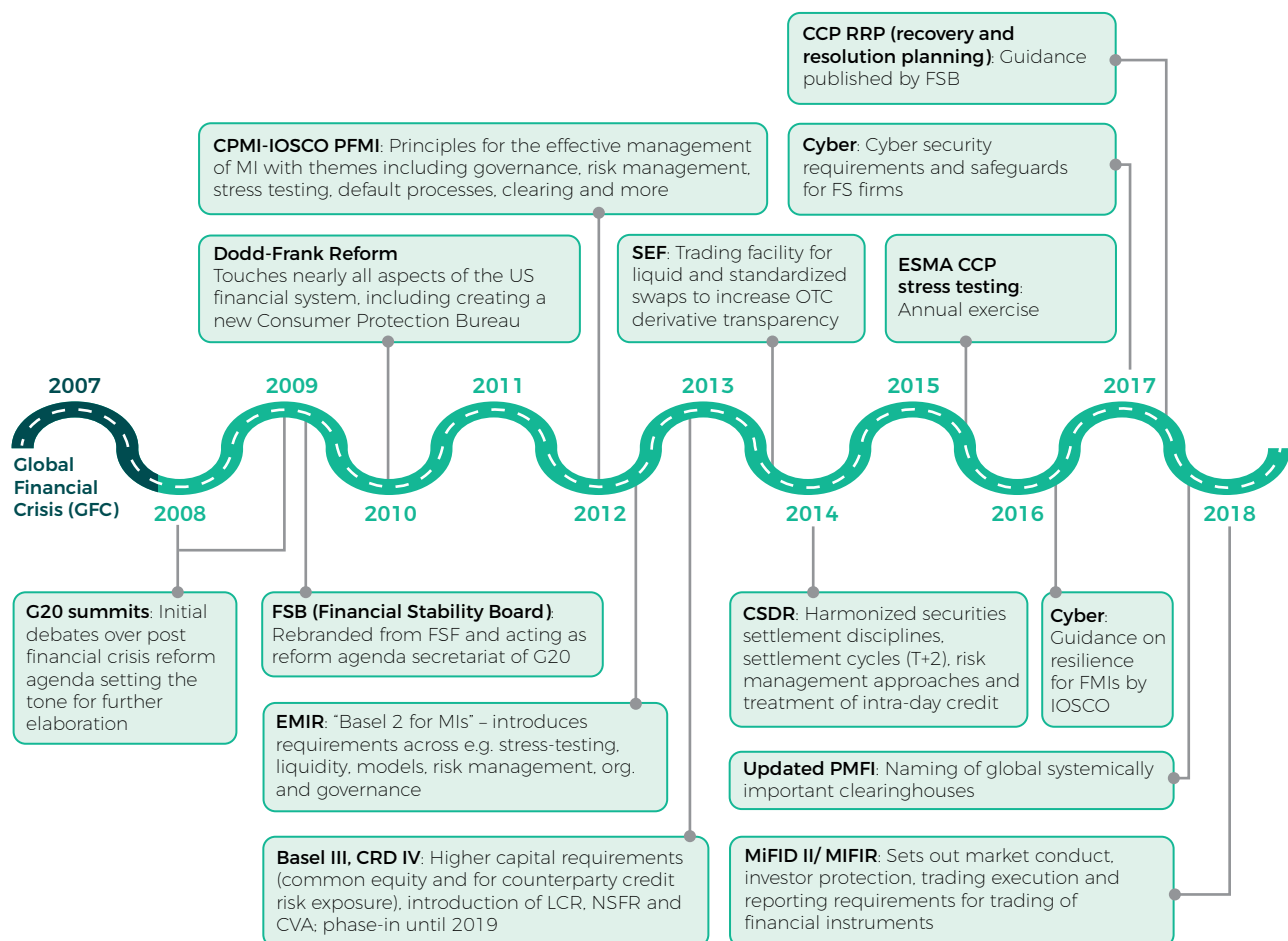
Regulations and guidance such as the CPMI-IOSCO *Principles for Financial Market Infrastructures* (and, in the EU, CSDR, and MiFID II/MIFIR) aim to strengthen risk management capabilities and governance, while other

Exhibit 3: Top social benefits generated by MIs, as perceived by market participants (Percent selected as a top-3 benefit)



regulations such as EMIR and the ESMA CCP stress-testing requirements seek to enhance resilience of CCPs.⁴ (See Exhibit 4.) In addition, new recovery and resolution plans and processes have been proposed globally. Over the past decade, the number of on-exchange securities trades and the number of derivatives contracts traded rose by over 107 percent and 65 percent respectively, and the notional volume of centrally cleared contracts has risen by more than 300 percent. Despite the enhanced responsibilities of MIs and some events of market turbulence, MIs continued to support record levels of market activity and a transition to new regulatory demands.

Exhibit 4: Post-crisis reforms/regulation and implications for market infrastructures⁵



4 CPMI-IOSCO, "Principles for Financial Market Infrastructures" (April 2012)
 European Commission, "Regulation on Settlement and Central Securities Depositories (CSDR) - (EU) No 909/2014" (2014)
 European Commission, "Markets in Financial Instruments (MiFID II) - Directive 2014/65/EU" (2014)
 European Commission, "Markets in Financial Instruments (MiFIR) - Regulation (EU) No 600/2014" (2014)
 European Commission, "European Market Infrastructure Regulation (EMIR) - (EU) No 648/2012" (2012)
 ESMA, "ESMA publishes results of second EU-wide CCP stress-test" (February 2018)

5 Regulations included in the above illustrations are not a comprehensive list of regulations influencing the global financial services industry. Timeline indicates when a regulation was or is due to be implemented, largely US/EU timelines

MAINTAINING ORDERLY MARKETS AT HKEX

Exchanges have a variety of tools to ensure market integrity, including volatility control mechanisms (VCMs) to maintain orderliness in the conduct of trading. The aim of these tools is not to prevent all volatility, but rather to forestall extreme volatility in asset prices, associated with, for example, panic selling or algorithmic trading errors that could lead to a flash crash.

Exchanges tailor these mechanisms to local circumstances and in response to local and global market distress events. For example, many exchanges took the initiative to enhance risk measures in response to the global financial market crisis that occurred in 1987 (Black Monday) where exchanges globally experienced extreme volatility starting in Asia upon market opening, subsequently moving to Europe and North America. Afterwards Hong Kong took the initiative, among other things, to create a unitary government supervisor for the financial market (the Securities & Futures Commission) with powers to establish a more robust and comprehensive regulatory framework for market participants with corresponding initiatives to address market volatility.

When IOSCO published guidelines on VCMs, HKEX took the initiative to enhance the current risk measures in place and decided to consult with stakeholders on their introduction in Hong Kong. Through these consultations and in view of local circumstances, HKEX adopted a VCM which entails a five-minute cooling-off period if a stock (or index futures contract) trades at $\pm 10\%$ ($\pm 5\%$) away from the last traded price five minutes before; normal trading resumes after this cooling-off period.

The adoption of VCMs in Hong Kong is an example of the effectiveness of combining high-level global standards with regulatory rules tailored to each jurisdiction.

REOPENING THE ATHENS STOCK EXCHANGE

In June 2015, amid a banking and sovereign debt crisis, Greek banks were closed, ATM withdrawals limited, and capital controls imposed in an effort to preserve liquidity in the Greek banking system. During this period, the Greek supervisory authority, the Hellenic Capital Market Commission, ordered the temporary closure of the markets operated by Athens Exchange as a result of the legally imposed banking holiday which resulted in the suspension of securities settlement for both the ATHEXCSD and the Bank of Greece Settlement System.

Before the market re-opened after the 25-day closure, the Athens Exchange had to think strategically about two axes, on how to close and re-open its market in an orderly manner and on how to minimize short- and medium-term repercussions to the international investor community.

Crisis management was used to tackle the first issue. Therefore, despite the banking holiday, ATHEXCSD proceeded with the completion of equities and bonds settlement without the need for additional margins by ATHEXClear members. The successful completion of this action was helped by the pre-margining model used by ATHEX trading platform and the appropriate parameters that were selected in the previous period of market operation by ATHEXClear. With no unsettled positions, market re-opening was the next concern, and was handled through the use of ATHEX volatility circuit-breakers, static and dynamic limits and auction period parameters optimization. The exchange observed how an ETF tracking the value of the top 20 Greek listed companies had continued to trade on the NYSE Arca platform during the market closure in order to understand likely price movements. During this planning the exchange maintained an on-going dialogue with its market participants and the official sector to ensure transparency and mutual understanding of its processes.

While the reopening of stock market saw the largest one-day decline on record for the Athens market, it was an important milestone in the economy's recovery and reintegration into the global financial system. Through a partnership between the Athens Exchange, regulatory authorities, and the wider financial sector, no margin defaults occurred and over the coming months capital controls and banking stocks short selling restrictions were gradually lifted, allowing full domestic and international participation in Greek markets. As a result the over 62% foreign participation in the Greek capital market remained intact.

MIIs are well aware of their expanded responsibilities in preserving market integrity in the post-GFC era. More than 70 percent of survey participants confirmed that supervision requirements increased over the past 10 years and predicted they will increase further over the next decade. In addition, more than 60 percent of survey respondents believe that market supervision is a core focus area driving improvement – this despite the lack of explicit change in the division of supervision responsibilities between exchanges and regulators across most markets.

The scope and scale of MIIs has also expanded. MIIs now typically offer a wider range of products, operate across the value chain (such as trading, CCP clearing, market data, and issuer services), and span geographies. Some MIIs have regulated banks within their portfolio of activities, which requires additional scrutiny on market integrity. These factors, taken together, create new challenges and opportunities for MIIs, particularly in relation to supporting continued market integrity.

3

TRENDS IN FINANCIAL MARKETS AND CHANGES TO THE BUSINESS ENVIRONMENT

This chapter explores recent trends in financial markets and their impact on the role of MIs in preserving market integrity. (See Exhibit 5.) We consider the changes in stakeholder expectations (including regulators, investors, market participants, and issuers) and shifts in the dynamics of financial markets (including new trading venues, financial products, and technologies).

Exhibit 5: Overview of enhanced expectations of stakeholders and evolution of markets

ENHANCED EXPECTATIONS OF STAKEHOLDERS

A



REGULATORS AND POLICYMAKERS

- Increased mandate for types of securities to be traded on exchanges and centrally cleared
- Enhanced supervisory requirements (e.g. circuit breakers, disclosure standards, broker licensing)
- Upgraded risk management standards
- Scrutiny on benchmark calculation

B



ISSUERS

- Expansion in issuer type (e.g. SMEs, PE/VC-backed entities)

C



INVESTORS

- Institutional investors actively advocating for corporate governance principles
- Buy-side increasingly looking at costs and benefits of existing market structure
- Exchanges playing an important role in attracting foreign investments in markets

D



MARKET PARTICIPANTS

- Increased complexity driven by algorithmic trading and associated advances in data analysis
- Rise of passive investment strategies
- Changing nature of trading including an increase in automated algorithmic trading

CONTINUING EVOLUTION OF MARKETS

E



VENUES

- Proliferation of trading venues and emergence of new technology platforms
- Regulatory effort to ensure continued efficient price formation
- Additional effort needed to consolidate data, track venues, and ensure best execution

F



PRODUCTS

- Innovation to develop new products and platforms e.g. provision of electronic execution venues for bonds
- New risks of market abuse that must be addressed

G



TECHNOLOGIES

- Continued electronification of trading including algorithmic trading and robo advisory
- Adoption of new technologies including big data and distributed ledger technologies

REGULATORS AND POLICYMAKERS

In recent years, policymakers have strengthened the regulatory framework with an emphasis on ensuring systemic stability and enhancing governance and good conduct in financial markets. Legislation has expanded the scope of instruments that must be transacted through MIs, which are investing to meet this increased demand. The new regulatory demands span financial and non-financial risk management (including cyber risk): conduct of business, investor and data protection, prudential requirements, and fitness requirements for individual risk-takers and market participants. The scope and complexity of these regulations has created an extraordinary challenge for MIs, market participants, and government regulators alike.⁶ Regulators broadly concur that ongoing dialogue between regulators, MIs and market participants is desirable and that in some areas industry standards and codes of conduct may be preferable to a proliferation of legal rules.

In this section, we focus specifically on reforms aimed at encouraging the on-market trading and clearing of financial instruments, and improving the governance of benchmarks and indices.

MIs AS PARTNERS IN SYSTEMIC RISK MANAGEMENT

Market integrity is closely related to the management of systemic risk. When systemic risks materialize, markets may suffer from pro-cyclical stress, become disorderly, and/or cease to effectively match buyers and sellers. Conversely, an absence of transparency or a lack of confidence in the integrity of markets may produce systemic stress.

As noted, one of the key post-GFC G20 regulatory reforms is the requirement for greater centralized clearing for certain financial instruments. Alongside these clearing obligations regulators have sought to strengthen the governance framework for CCPs, including enhanced oversight in line with their status as systemically important financial institutions (SIFIs).⁷ The purpose of these reforms is to improve the transparency of risks by concentrating activity in CCPs and to enhance resilience planning for periods of market stress.

CCPs have responded by investing heavily in enhanced risk management, modelling, and stress-testing capabilities. Part of this risk management includes collaboration with regulators on multi-CCP stress testing, to understand systemic risks and interconnectedness within the wider financial system.

⁶ 111th United States Congress, "Dodd-Frank Wall Street Reform and Consumer Protection Act" (January 2010)

⁷ Over 76.5 percent of surveyed market infrastructures said they were designated as SIFIs

Regulators have also introduced new requirements for on-exchange trade execution, for example, the EU's MiFIR Share Trading Obligation. Meanwhile, alternative trading venues and modalities are now subject to greater regulation, bringing them closer to the standards placed on regulated exchanges and ensuring they do not impede the transparent price discovery process.

CONDUCT IN BENCHMARKS AND INDICES

Effective oversight and governance of benchmark and index calculation are critical for market integrity particularly as the growth of passive investment strategies means more money tracking market indices. There are more than three million indices globally, and ETFs represented seven out of the top 10 most actively traded securities in the US in 2016.⁸ According to a Deutsche Bank report, ETPs' assets under management rose from US\$584 billion in 2006 to US\$3.5 trillion in 2016, which represents a 500% change over 10 years.⁹

Policymakers, standards setters, and regulators have sought to ensure the soundness of benchmarks and indices, with the introduction at the global level of IOSCO's Principles for Financial Benchmarks, which aim to address "benchmark governance, integrity, methodology, quality, and accountability."¹⁰ At the regional level, the EU has introduced its own benchmark regulation to ensure the accuracy and integrity of benchmarks.

Some MIs have responded by offering benchmark administration services. ICE, for example, calculates the global benchmark prices for gold and silver through electronic auctions overseen by its Precious Metals Oversight Committee. European exchange groups have meanwhile invested significantly to ensure the indices they provide comply with relevant EU regulations.

ISSUERS

The appropriate supervision and oversight of the entities who use financial markets to raise capital and whose securities are publicly traded is a critical element of market integrity. For example, setting minimum listings standards and ensuring appropriate disclosure of information is integral to the protection of investors. In this section, we examine the changing profile of issuers (including small- and medium-sized enterprises (SMEs) and larger, later-stage firms as well as state-owned enterprises) and how MIs are responding to ensure the continued preservation of market integrity.

8 IPE, "Asset Management Roundup: Research reveals Scale of Index Industry" (January 2018)
FT, "ETFs are eating US Stock Market" (January 2017)

9 Deutsche Bank, "ETF Annual Review & Outlook" (January 2017)

10 IOSCO, "Principles for Financial Benchmarks" (July 2013)

SMALL- AND MEDIUM-SIZED ENTERPRISES

Allowing companies to access external finance enables funding of new investments, innovation, economic growth and job creation. To accelerate economic and productivity growth, policymakers are looking to exchanges to address some of the funding gap for SMEs. This gap is partly the result of the regulatory constraints placed on bank-based intermediation imposed in the wake of the GFC. Many exchanges have responded by launching dedicated SME offerings aimed at reducing fixed regulatory costs associated with listing, while still ensuring appropriate levels of investor protection. At the end of 2016, among 65 WFE member exchanges, there were 36 SME platforms, with over 7,000 listed companies and a combined market capitalization of US\$1.4 trillion (up from fewer than 1,000 listed companies in 2006).

STATE-OWNED ENTERPRISES (SOEs)

The rapid growth of economies with state-directed developmental models has increased the relative influence of state actors in the global economy. State actors are consequently becoming more prominent participants in financial markets.

While the listing of public equity in SOEs is not a new phenomenon, it has become more common. The Fortune Global 500 index of the largest listed companies by revenues included 102 state-owned enterprises in 2017, compared to 27 in 2000.¹¹ As SOEs raise capital or simply list on markets, exchanges and regulators seek to maintain rigorous standards of investor protection, while accounting for the idiosyncrasies of these institutions (such as golden-share voting rights for state owners, state-appointed directors, or politically-determined objectives). Some 44 percent of WFE strategic survey respondents indicated they had tailored listing requirements for state-owned enterprises in their jurisdictions.

PRIVATE EQUITY AND VENTURE CAPITAL (PE/VC) BACKED ENTITIES

A number of large PE/VC backed entities (e.g. technology firms) have listed in the financial markets globally and command significant market capitalization today. These businesses have tended to list at a later stage in their development compared to historical IPOs and are often much larger at the moment when they do list. To account for this dynamic, and attract such companies to the public markets, exchanges have adjusted listing requirements, particularly capital and ownership structures, and explored new issuance models. The upcoming direct listing of Snapchat will prove illustrative in this regard.

¹¹ Ernst & Young, "The changing Headquarters Landscape for Fortune Global 500 Companies" (October 2017)

ENHANCING SOE GOVERNANCE AT B3

Throughout its history, exchange group B3 has been instrumental in bringing international best practices to corporate Brazil, developing the attractiveness of the country as an investment destination. After a 2014 corporate scandal threatened investor confidence in the governance of Brazilian SOEs, B3 developed a Corporate Governance Program for SOEs, in an effort to enhance transparency while ensuring appropriate internal controls, board-level governance practices, and shareholder oversight.

Brazilian SOEs are likely to have public interest missions in addition to their profit motive. The political nature of defining the public interest and balancing it against the interests of shareholders is one of the crucial areas of difference between SOEs and private corporations. In developing their certification program, B3 looked to the OECD's Guidelines on Corporate Governance of State-Owned Enterprises as well as the international best practices, such as the presence of a Statutory Audit Committee and shareholder oversight of related-party transactions.

To be certified under the program, SOEs must meet several mandatory criteria and a threshold of best practices in other areas. This may include the appropriate monitoring of related party transactions and the presence of a statutory audit committee. B3 certifies applications and undertakes ongoing monitoring.

Partly inspired by B3's corporate governance program, the Brazilian government passed a law to enhance the business practices of all SOEs, including bookkeeping and director nomination. Two SOEs, representing a market capitalization of US\$88 billion, have been certified since the program began, with another three in the pipeline.

INVESTORS

Facilitating orderly investor participation in markets, while maintaining a level-playing field, are key elements of ensuring market integrity. MIs serve a diverse set of investors with differing priorities and requirements for disclosure, market access, and investor protection. As investor expectations and composition change, MIs have responded through, for example, investing in education of retail investors, adjusting disclosure requirements to take cognizance of evolving investor needs, ensuring the fair dissemination of regulated news, and the design of technology underlying matching engines and best execution solutions. In this section, we focus on the increasing prominence of institutional investors and their focus on market structure considerations, the trend towards greater demand for environmental, social and governance (ESG) disclosures, and the preservation of market integrity in the context of cross-border investment.

INSTITUTIONAL INVESTORS AND MARKET STRUCTURE ISSUES

Over the past 50 years, at least in more developed markets, ownership of public equity has become increasingly concentrated in the hands of institutional investors. One study estimates that as at 2011, institutional investors owned around 73% of the outstanding shares of the top 1000 US companies by market capitalization, compared with 80% retail holding in the 1970s.¹² In accordance with their increased prominence, these

¹² Patrick Jahnke, "Voice versus Exit: the Causes and Consequence of Increasing Shareholder Concentration" (August 2017)

investors are becoming more vocal about a range of market structure related issues and demands of MIs. BlackRock, for example, has expressed views on CCP resiliency, recovery and resolution, while Norges Bank Investment Management has raised specific concerns related to high-frequency trading and is funding research into the effect of regulatory and technological changes on market structure and transparency. Given their size and importance, MIs and regulators must consider their views while still accommodating sometimes competing demands from other investor groups and market intermediaries.¹³

ENHANCEMENTS TO CORPORATE GOVERNANCE AND DISCLOSURE

Investors, such as sovereign wealth funds, public-sector pension funds, global asset managers, millennial retail investors, are pushing for enhanced disclosure of financially material ESG information. These include climate risks, compensation practices, diversity and inclusion, labor relations, responsible sourcing, and supply-chain management. Furthermore, investors are starting to demand that large corporates articulate their stances on the diverse challenges facing society.¹⁴ These investor demands are expanding the conception of integrity in public markets.

PROMOTING DIVERSITY AT THE JSE

The South African corporate sector and the Johannesburg Stock Exchange (JSE) have led progress in corporate governance globally. As the empowerment of previously disenfranchised groups is recognized as a core societal challenge, both the government of South Africa and its corporate sector – embodied in the King Committee on Corporate Governance – are promoting social considerations, including Black Economic Empowerment (BEE), as core pillars of corporate sustainability. The JSE has played a leadership role in mainstreaming sustainability issues and recently adopted two amendments to its listing requirements in this regard, including:

- The appointment of a board-level social and ethics committee
- A board-level policy on race diversity alongside annual reporting on its application

The JSE is also demonstrating its commitment to societal transformation through an Empowerment Segment, which facilitates trading in share classes associated with the country's BEE share scheme. Even organizations that are not listed on the JSE's Main Board or AltX can list their BEE share schemes on the Empowerment Segment.

JSE is responding to the expectations of its stakeholders and acting on its social purpose by pursuing policies that encourage high standards of corporate governance, the disclosure of race diversity policies, and broad-based share ownership. These developments are an example of how the concept of market integrity is evolving, and how each jurisdiction and MI will have unique considerations in tailoring its standards to meet local needs.

¹³ Norges Bank Investment Management, "Research Grant to Study the Effect of Technological and Regulatory Changes" (February 2018)

BlackRock "Resiliency, recovery and resolution: revisiting the 3 R's for Central Clearing Counterparties" (October 2016)

¹⁴ BlackRock, "Larry Fink's Annual Letter to CEOs – A Sense of Purpose" (January 2018)

Because exchanges are often responsible for determining disclosure requirements and monitoring compliance, they tend to be at the forefront of building consensus and setting standards. Exchanges have taken the lead by requiring enhanced disclosure in their listings requirements or through issuing ESG-disclosure guidance for listed issuers. Between 2015 and 2017, 24 exchanges published ESG disclosure guidance for their listed issuers, and a further 12 have committed to doing so.¹⁵ Exchanges also provide ESG-related training and information services for their listed issuers.

FOREIGN INVESTMENT AND THE ROLE OF THE EXCHANGE

Cross-border investment is an engine of economic development and a substantial source of capital in emerging markets. The IMF estimates total non-resident capital inflows to emerging markets at US\$200 billion in each of the first two quarters of 2017. Through August 2017, foreign purchases of emerging market stocks and bonds equaled an estimated US\$205 billion.¹⁶ Cross-border investment and market participation brings benefits to markets in terms of enhanced liquidity and the development of the local buy-side and investment community; however, it also poses new considerations for market integrity (such as cross-border supervision, currency convertibility in trade settlement, and equitable treatment of foreign investors). Many emerging

ENCOURAGING FOREIGN PARTICIPATION AT TADAWUL

As part of its Vision 2030, the Kingdom of Saudi Arabia is opening its economy and financial markets to increased foreign participation. The Tadawul stock exchange in Riyadh is playing an instrumental role in these efforts, with a gradual path of liberalization that permits Qualified Foreign Investors (QFI) on its market and the introduction of modern market practices such as short selling. Through these measures, it seeks to facilitate fair and orderly trading, while mitigating the systemic risks associated with market opening and cross-border portfolio flows.

First introduced in 2015, the QFI regime permits foreign investors to invest directly in Saudi securities. In 2017, Tadawul further liberalized the QFI regime and implemented a regulatory framework allowing securities borrowing and lending as well authorizing short selling of securities – a first in the Gulf Cooperation Council region.

Tadawul introduced the possibility of short selling with rules aimed at preserving market integrity. Short selling has been limited to so-called covered short selling, requiring settled shares to be in the account of the seller before the sale takes place. A per-security cap of 10 percent of outstanding shares has been added to limit the potential impact of short selling on market dynamics. Finally, an uptick rule was included to prevent disorderly market declines in the case of heavy short selling.

The approach of having a tightly controlled set of rules initially and then moving gradually—with time and experience—to more relaxed ones is a safe path for emerging financial markets like Saudi Arabia. It provides time for market participants, as well as regulatory authorities and the exchange itself, to better understand market trends and practices before further relaxing rules.

¹⁵ See the Sustainable Stock Exchanges Initiative: SSE campaign to close the ESG guidance gap

¹⁶ IMF, "World Economic Outlook – Seeking Sustainable Growth: Short-Term Recovery, Long-Term Challenges" (October 2017)

market governments have adopted economic strategies to encourage such foreign investment and look to their local exchange as a key partner in such intermediation. MIs have, for their part, introduced mechanisms and adjustments to market structure to facilitate foreign investment and market participation.

MARKET PARTICIPANTS

Technological advances, coupled with changing regulatory requirements, have impacted how market participants (which includes entities such as broker-dealers, proprietary traders, asset management companies, and clearing members of MIs) interact with the market and the requirements with which they must comply. As their trading strategies and investment mandates evolve, MIs must adapt their mechanisms for preserving market integrity. This section considers how MIs have responded to algorithmic trading, and the rise of passive investment strategies.

ALGORITHMIC TRADING

A range of market participants, including proprietary trading firms, securities broker-dealers, and asset managers, use algorithmic trading strategies. This has revolutionized the microstructure of markets in recent decades. Algorithmic trading strategies may serve different objectives, including: achieving best execution for clients; sewing together trading on fragmented venues through price arbitrage, including through low-latency (also known as high frequency) trading; and ensuring that large orders do not move the market

These trading techniques have their benefits but may pose novel risks in certain circumstances.¹⁷ Exchanges have responded to developments in trading

MANAGING LOW-LATENCY TRADING AT JPX

In response to evolving technology and diversifying market needs, Japan Exchange Group (JPX) has offered a low-latency trading environment while strengthening risk controls and implementing more sophisticated self-regulation. It is also working closely with regulators and low-latency traders (LLTs) to ensure the smooth implementation of a new law designed to enhance market integrity.

As the Japanese government has amended its Financial Instruments and Exchange Act¹⁹ to require a new registration regime for LLTs, JPX is working with these institutions to ensure their compliance with requirements, including the reporting of corporate and financial information, trading strategy, and the presence of internal control mechanisms to prevent irregular orders and unfair trading.

JPX's Tokyo Stock Exchange and Osaka Exchange have gone beyond the letter of the law, requiring that LLTs indicate the trading strategy (market making, arbitrage, directional, or other) in each order message. Through these practices, JPX aims to ensure that risks inherent in low-latency trading are adequately controlled and that the integrity of Japanese markets is preserved.

¹⁷ In 2012, the UK Government published a report based on the collaboration of 150 experts in 20 countries, exploring the future of computer trading in financial markets. It concluded "the available evidence indicates that high frequency trading (HFT) and algorithmic trading (AT) may have several beneficial effects on markets. However, HFT/AT may cause instabilities in financial markets in specific circumstances."

technology by investing in their venues' connectivity and matching engines. They have also evolved their means of monitoring, analysing, and mitigating the risks associated with new trading modalities. In some instances, exchanges and SROs are investing in advanced data science to discover new patterns in the large data sets. For example, the US regulatory service provider, Financial Industry Regulatory Authority (FINRA), is now deploying technology to detect new forms of market manipulation such as layering, spoofing and wash trades.¹⁸ As described below in the report section "Data processing, technology and surveillance capabilities", exchanges are also deploying machine learning as a surveillance tool to root out market abuse. Other methods to ensure continued market integrity include use of algorithmic testing, trade flagging, and the widespread expansion of volatility control mechanisms such as circuit breakers. Between 2008 and 2016, the proportion of exchanges using circuit breakers increased from 60 percent to 86 percent.¹⁹

MANAGING COMPLEXITY AT DEUTSCHE BÖRSE AFTER THE BREXIT VOTE

The result of the United Kingdom's referendum on its membership of the European Union was an unexpected political event that took financial markets by surprise. Upon opening the following day – June 24, 2016 – European markets saw €25.5 billion in trading – at least half of a typical day's volume – by just 9:10 a.m. Germany's DAX index prices declined 6.8 percent, while Euro STOXX, FTSE 100, and CAC 40 all opened down between 7 percent and 9 percent.

Even when confronted with outstanding trading volumes, significant price declines, and high volatility, trading safeguards contributed to the efficient absorption of these shocks. For example, by switching from continuous trading to auctions, Deutsche Börse Group (DBG) allowed market participants to incorporate new information into meaningful prices.

DBG has an integrated safety architecture that addressed Brexit day volatility in three key ways:

1. DBG's scalable systems were able to handle the additional volumes (cash market volume was approximately three times higher than on the average trading day and the number of trades in derivatives markets rose by approximately 75 percent)
2. DBG's markets opened as planned on June 24, 2016. Almost 4,000 volatility interruptions were triggered to protect investors from extreme price movements – compared to the daily average of approximately 430 volatility interruptions. When certain price thresholds are reached, automatic continuous trading is temporarily suspended, and the affected instruments are placed into an auction to recalculate their value. This ensures orderly price discovery
3. The functioning of DBG's markets is also ensured by the interplay of other systems. Real-time risk management and advanced risk systems protect participants from increased price volatility. Standard Risk Management procedures were applied and worked as designed. The strong intraday market moves resulted in a more than usual number of Margin Calls. No specific hiccups or delays occurred, even with the inherent amounts being rather high compared to regular figures – especially in the opening hours on June 24, 2016

Trading and Risk safeguards contributed to the market's appropriate functioning, and thus broader financial stability, the day after the Brexit vote.

¹⁸ FINRA, "Equity Market Surveillance Today and the Path ahead" (September 2017)

¹⁹ WFE & Gomber et al., "Circuit Breakers – A Survey among International Trading Venues" (September 2016)

PASSIVE INVESTMENT

As noted earlier, passive investment strategies are becoming increasingly common. In the US, index-trackers and ETFs saw inflows of over US\$1.4 trillion over the 2007-2017 period; outflows from actively-managed mutual funds were equal to US\$1.2 trillion over the same period.²⁰

These investment approaches require a periodic rebalancing of large blocks of investment assets, which differs from the trading styles of active intermediaries. Furthermore, many funds have a mandate to track a benchmark that is calculated daily using closing prices. This is leading to increasing participation in markets' daily closing auctions, where liquidity is concentrated.

As the closing auction becomes an ever-more important part of the price discovery process, MIs are expanding their offerings in this area and taking additional steps to ensure the integrity of these processes. For example, to promote responsible and prudent practices in closing auctions, HKEX has recently introduced a no-cancellation period and random closing time for the auction.

TRANSPARENCY, REPORTING, AND COMPLIANCE SOLUTIONS

Market participants must also meet increasingly demanding transparency and regulatory reporting requirements. Given their central role in financial markets and access to data, MIs are well-placed to offer cost-effective solutions in this area.

Several EU exchanges groups have launched Approved Reporting Mechanisms to help market participants meet new MiFID II transaction reporting requirements. These services enable financial institutions to meet their obligations to report to EU supervisors while assisting with the collection, validation, and enrichment of data. The integration of such compliance solutions is an example of MIs working with participants and end users to achieve cost-effective compliance.

VENUES

There has been significant growth in the number of alternative trading venues and modalities (such as multilateral trading facilities and dark pools). Post-crisis, this proliferation continues with the emergence of new venues, such as the US Swap Execution Facilities (SEFs) and EU Organized Trading Facility (OTFs). The CFTC lists 28 SEFs in the US while ESMA reports that there are eight OTF operators, following the coming into force of MiFID II.²¹

²⁰ FT, "ETFs are eating the US Stock Market" (January 2017)

²¹ CFTC, "Trading Organizations – Swap Execution Facilities (SEF)" (June 2017)

ESMA, "Registers and Data" (last accessed March 2018)

This increase in trading venues has in some instances resulted in fragmentation of trading, making it more difficult for market participants to achieve best execution and potentially resulting in inefficiencies in price formation.²² Addressing these is critical to ensuring market integrity. Spurred by the introduction of MiFID II and other regulations, MIs have evolved their compliance and reporting services. Most exchanges or trading venues for instance offer best-execution transaction reporting solutions. These developments have markedly improved transparency and reporting standards.

PRODUCTS

Across financial markets globally, MIs are constantly focused on developing new products and asset classes to serve market participants and end users. In emerging markets, the focus is on expanding beyond equity to derivatives and structured products. In developed markets, the growth of low-cost ETFs has revolutionized the accessibility of affordable investment options for the retail client, dovetailing with the growth in robo-advice. In many instances, supervision capabilities and approaches cannot be linearly extended to new asset classes/products and require capability building and standard setting by MIs.

For example, bonds, which in many jurisdictions are primarily traded OTC through voice brokers, are progressively moving towards electronic trading. In the five years to end-2014, average daily trading volumes of fixed income on electronic platforms rose in aggregate by about 40 percent.²³ This shift has gained urgency as new bank capital requirements make holding inventories of bonds less economically viable. Exchange groups and others are responding by building and/or acquiring new electronic matching systems for bond trading (such as ICE's recent acquisition of BondPoint).²⁴ Observers have noted the potential for recent declines in corporate bond liquidity to be ameliorated by the deployment of big data and machine learning capabilities on electronic markets.²⁵

In addition to fostering liquidity, electronic trading and trade reporting has the potential to lower costs for investors. When the TRACE reporting system was introduced in the US, the cost of bond trading declined significantly; investors in Europe are hoping for similar results as MiFID II/MiFIR is implemented.²⁶

22 IOSCO, "Transparency and Market Fragmentation" (November 2001)

23 BIS, "Hanging up the Phone – Electronic Trading in Fixed Income Markets and its Implications" (March 2016)

24 FT, "ICE to buy Bond Trading Venue from Virtue for US\$400m" (October 2017)

25 Greenwich Associates, "Technology transforming a vast Corporate Bond Market" (October 2017)

26 FT, "Mifid II's impact on Fixed-Income Transparency will be profound" (October 2017)

TECHNOLOGY

Technology has always been a major force for change in markets. MIs invest in innovation not only to pursue new opportunities and reduce cost, but also to protect end users and market participants. Protecting these parties from market abuse, disorderly trading environments, and cybersecurity threats is integral to MIs' market integrity mandate. In our Strategic Survey, 81 percent of respondents regarded technology leadership as a very important means of enhancing financial markets in their jurisdiction.

In this section, we look at how MIs are pursuing more efficient operations and compliance solutions through technology by harnessing big data and distributed ledger technologies, while responding to increasing financial market complexity with new means of digital surveillance. We also examine how MIs are investing to address growing cybersecurity threats.

DATA PROCESSING, TECHNOLOGY AND SURVEILLANCE CAPABILITIES

More data than ever is being produced in line with statutory requirements for pre- and post-trade transparency and regulatory reporting; the proliferation of data has outpaced the capacity of financial institutions to organize and analyze it. This is changing, as MIs begin to invest heavily in big data and machine learning to make better use of the large and complex sets of information.

Exchanges are also using AI to monitor markets more effectively. Machine learning and AI may be used to eliminate human bias in the market surveillance function, analysing and discovering new patterns in the data. For example, data from electronic communications can be linked with order, cancellation, and amendment data, providing a holistic view of a market participant's activity. This may be critical in assisting the exchange in monitoring, detecting, and deterring abusive trading activity. NASDAQ has, for example, developed a strategic alliance with AI technology provider, Digital Reasoning, which gives compliance teams a view across trade data and communications, based on natural language processing and behavioral analysis. The use of AI on data collected by MIs is likely to increase in the future as the underlying data-sets become cleaner and broader over time.

27 IOSCO, "Cyber Security in Securities Markets – An International Perspective" (April 2016)

28 IOSCO & WFE, "Cyber-crime, Securities Markets and Systemic Risk" (July 2013)

CYBERSECURITY IN FINANCIAL MARKETS

According to IOSCO, cybersecurity risk is a “growing and significant threat to the integrity, efficiency, and soundness of financial markets worldwide.”²⁷ A 2013 survey of WFE members reported that more than half had experienced a cyber attack in the previous year.²⁸ Since then, cyber attacks have become “more frequent and more costly for organizations and societies more broadly.”²⁹ MIs recognize the challenge of ensuring effective cybersecurity: in our Strategic Survey, large-scale cyber attacks was the most frequently cited risk respondents perceive in their operating environment.³⁰

Vulnerabilities exist across MIs, including with users, networks, devices, software, processes, information storage, applications, services, and systems (directly or indirectly) connected to networks. MIs have responded by investing significant time, effort, and resources toward implementing appropriate policies and regulations and ensuring their systems are best-in-class, resilient and tested regularly to stay one step ahead of cyber criminals. WFE members have collaborated on cyber resilience standards³¹ to share industry best practices as well as Cyber Risk Staff Behavioral Standards that MIs can use when designing their staff training and awareness programmes. In addressing the demands of enhanced market integrity standards, and factoring in the greater electronification and inter-connectivity of markets, MIs will need to continuously improve their cyber defenses.

²⁹ Ibid.

³⁰ 19 out of 31 respondents identified this within the top five risks most likely to affect their operating environment in the near future.

³¹ WFE, “Exchanges and CCP Cyber Resilience” (April 2017)

4

A VISION FOR THE FUTURE ROLE AND CAPABILITIES OF MARKET INFRASTRUCTURES IN ENSURING INTEGRITY

We believe that the trends discussed in the previous chapter will result in five key shifts over the coming decade with respect to the activities of MIs. (See Exhibit 6.)

Exhibit 6: Key shifts: A vision for the future

FROM	TO
1 Meeting the core market integrity standards Perceived low differentiation in market integrity outcomes across most markets	Higher standards of market integrity as competitive differentiator Well-defined measures of market integrity outcomes across venues enabling differentiation
2 Supervision as regulatory function Supervision focused on compliance with exchange rules/regulatory policies	Supervision as regulatory function + offerings that reduce industry-wide cost of compliance Potential for MI to support industry with a broader suite of regulatory and compliance solutions to reduce overall costs of compliance
3 Early stage cooperation Cooperation focused on policy input and event diagnostics	Broad industry cooperation Pro-active, on-going industry cooperation to enhance market integrity
4 Post fact surveillance Near-real time, pre-emptive approach to surveillance as best practice	Real-time surveillance Real-time, preventive surveillance as the standard and intensive use of AI
5 Rules and regulations based supervision Focus on defining policies and ensuring adherence to standards as primary approach	Interactive, outcome oriented supervision Focus on definition of standards and adherence to principles – enhancing ownership of compliance across supervised entities and increasing the interactions of market infrastructures with supervised entities

HIGHER STANDARDS OF MARKET INTEGRITY AS A COMPETITIVE DIFFERENTIATOR

Market integrity is taken very seriously across the the capital markets ecosystem. MIs, market participants, and regulators have implemented numerous tools to support the integrity of markets while also having large numbers of professionals dedicated to this function. Nevertheless, government regulators are increasingly identifying and penalizing market integrity-related breaches, ranging from price fixing and order prioritization, to transparency.³² The tolerance of regulators, investors, and the public for such behavior was already low and this continues to remain a topic of paramount importance.

As markets continue to evolve – with increased transparency, improved technology, greater focus on conduct, and tighter regulations – we see enhanced market integrity emerging as a key competitive differentiator across the industry. After all, well-functioning markets generate confidence and support the efficient flow of capital, and so, fundamentally, economic growth.

³² Trillium, "2017 Trade Surveillance Enforcement Year in Review" (December 2017)

We see five key developments occurring here:

Positioning market integrity as a competitive differentiator: Exchanges and other trading venues will increasingly tout their market integrity capabilities, and sell-side brokers, their compliance standards, when positioning to win business effectively. This will make market integrity a competitive differentiator alongside the more familiar aspects such as pricing, liquidity, and technology.

User shift toward trustworthy venues: Investors with fiduciary and conduct concerns will seek to trade in markets they trust, and issuers will prefer markets with strong standards. As such, the risk premium associated with participating in markets perceived to have lower integrity, or those not at the peak of the industry standards, will rise.

ESG reporting standards: As highlighted in Chapter 3, investors have called for improved ESG reporting. As investors place more emphasis on wider metrics of performance, exchanges will need to continue their efforts to ensure greater disclosure of investor-relevant ESG information, while making it easier to access and compare such information across listed companies.

Differentiated standards and market integrity: Also discussed in Chapter 3, there is the potential for exchanges to support differentiated listings standards to facilitate the needs of a wider pool of issuers such as SMEs and PE/VC backed enterprises. As exchanges develop their offerings to meet these needs, they will need to ensure these standards still promote high levels of market integrity from listed issuers.

Greater availability and comparability of integrity data: There will be increasing transparency with respect to market integrity activities, including granular dashboards and scorecards to measure integrity. This reporting will support the needs of the marketplaces as well as market participants. Common standards and metrics will emerge to support the comparison of venues.

We see early signs of this already. Market integrity, regulatory and compliance functions, and better reporting are being positioned as fundamental differentiators of service across the industry. In the US, certain exchanges have introduced so-called speed bumps and marketed these to investors and market participants. Similar moves have been seen for marketplaces focused on segments, such as SME issuers, and other asset classes, such as the swaps markets, FX, and options market. The SEC in the US have run numerous experiments to test various approaches to improve market integrity, as well broadly engaging the industry ecosystem.

In the future, MIs with robust market integrity will attract improved liquidity and carry lower risk premia, resulting in a virtuous cycle for all participants. This will further expand the opportunity for market integrity to be a core competitive advantage, particularly in markets operating multiple exchanges.

SURVEILLANCE AND SUPERVISION AS A CLIENT OFFERING

Market participants continue to face a range of new enhanced compliance, conduct, regulatory, reporting, and data standards. These standards contribute to heightened market integrity across the ecosystem but are often difficult to integrate, require significant collaboration across the ecosystem, and are costly. Recent requirements, including FATCA, KYC, AML, trade reporting, transaction cost analysis (TCA), and MiFID II, have led to increased operational complexity which market participants must manage efficiently – particularly in an environment where players are facing margin pressure and suppressed returns.³³ As a result, participants are seeking cost-effective ways of achieving robust regulatory compliance standards. Many of these enhanced standards require access to voluminous data, processing capabilities, and interaction between participants. MIs, which already serve multiple roles at the centre of many markets, are well-positioned to support the industry as it transitions.

We see two key developments occurring here:

MIs to develop client end-solutions to support the industry: Given their access to order flow, their positioning in between participants, and data-processing capabilities, MI firms are well positioned to offer industrywide solutions. These may leverage firms' strong understanding of market data, order flow, and connectivity and can be sold onward to support clients. Such endeavors have the potential to save hundreds of millions of dollars in compliance costs across the industry.

Increasing importance of quality market and operational data: The availability of high-quality market data together with internal operational data on traders' activities for example will be fundamental to support applications used for surveillance across the ecosystem of market participants, compliance requirements, and other regulatory requirements. We expect the demand for market data as an enabler for better supervision to continue to grow strongly in the medium-term.

MIs are already major providers of adjacent trading support solutions to market participants. For example, most marketplaces now provide TCA. In some markets, compliance-related value-added services are becoming table-stakes, representing a large evolution in the role MIs play in supporting market integrity. As trading continues to increase in complexity, and there is an increasing focus on surveillance of market participants, this trend is expected to continue. SMARTS is a similar product offered by NASDAQ, which has invested in developing client solutions. Furthermore, the pricing and reference data services of many exchanges form a backbone for risk analytics, valuation, and regulatory reporting requirements across the industry. There are also several KYC solutions under development across the industry at the moment.

³³ 111th United States Congress, "Foreign Account Tax Compliance" (March 2010)

BROAD INDUSTRY COOPERATION

Given the inter-linkages between markets – dual-listed companies, foreign-listed companies, derivatives and cash market products, multiple trading venues (lit and dark) for products – enhancing market integrity and supervision will require collaboration across MIs and the markets' ecosystem. The wider ecosystem includes issuers, brokers, investors, analytics, and custodians, amongst others. Recognizing potential competitive challenges, MIs could play a key coordinating role in driving this collaboration, given their uniquely comprehensive view of the market and ability to liaise with all the stakeholders. The inter-connectivity of events across markets means that maintaining robust market integrity will require assessing events within a wider context, to truly understand market drivers and pre-empt issues. It is worth noting that MIs are already cooperating in aspects of cyber-risk management (such as sharing threat intelligence and best practice), recognizing it is in the interests of the wider market to do so.

We see three key developments occurring here:

Integrity across the ecosystem: Maintaining effective market integrity will be seen more as an ecosystem challenge than a market, location, or trading desk challenge. Market integrity challenges, metrics, and outcomes will be redefined, recognizing the broader system-wide causes and effects. For example, a single faulty algorithm executing trades can cause a selloff with contagion effects in numerous other markets, as was the case during the flash sale of the British Pound in October 2016. MIs, participants, and regulators will increasingly engage to define common protocols to address such challenges and coordinate their planning efforts.

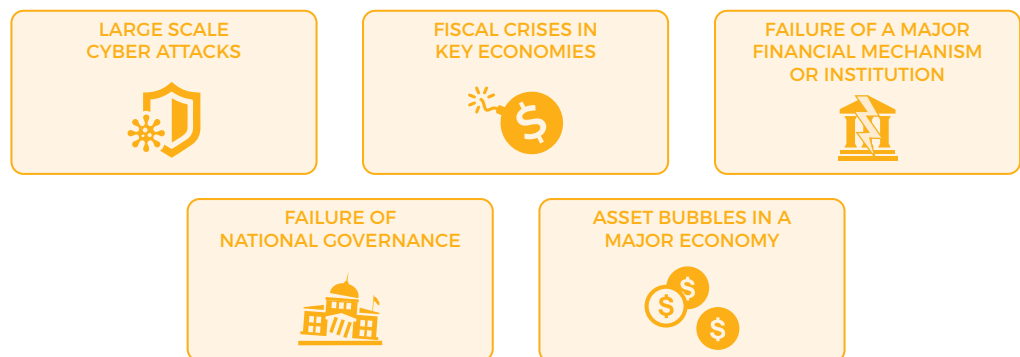
Definition of global standards for integrity: Coalitions of market participants will have to develop global, standardized solutions to threats like cyber risks. That is because the threat facing one firm is likely to be faced by others. Given these challenges, there is potential for innovation, investment, and coordination to be mutualized, saving cost while also supporting the standardization of solutions. At a minimum, increased coordination will be necessary to align solutions so as to ensure rapid dissemination of information and sharing of ideas. We are already seeing early signs of cross-industry collaboration to tackle these threats. For example, Soltra is a tool to share cyber threat intelligence across communities.

Increasing joint supervision of entities: Finally, there is more potential for the joint supervision of some markets, where multiple marketplaces exist and where there are significant derivatives and cash products covering the same underlying securities. Joint supervision can align standards – increasing transparency and the effectiveness of supervision, and ensuring improved market integrity.

The below diagram highlights five major macroeconomic risks which affect markets more broadly. (See Exhibit 8.) Each of these risks represents a challenge to almost all MIs, participants, and regulators. Effective data collection across the ecosystem, processing, and aligned supervision together with common playbooks and standards can assist in a coordinated rapid response in the event of such events.

Managing this enhanced cooperation will require a careful balancing act between regulators and other market participants to ensure adequate and efficient surveillance. There is no one-size-fits-all answer, and each market will need to pick a model suitable to its local context while global issues will require further efforts to develop similar global collaboration models. This balance will be driven by market maturity and the regulatory capacity of the exchanges in each jurisdiction.

Exhibit 7: Top 5 macroeconomic risks likely to affect the market infrastructure operating environment in near-future



REAL-TIME SURVEILLANCE

Greater fragmentation of liquidity across venues and a diversity of traders have contributed to increased market complexity. This means, for example, determining the triggers of potentially disruptive market events such as flash crashes is incredibly difficult, especially when traders are operating simultaneously across venues. This challenge is acknowledged by all, from exchanges, to regulators, to trading floors of brokers and investment managers.

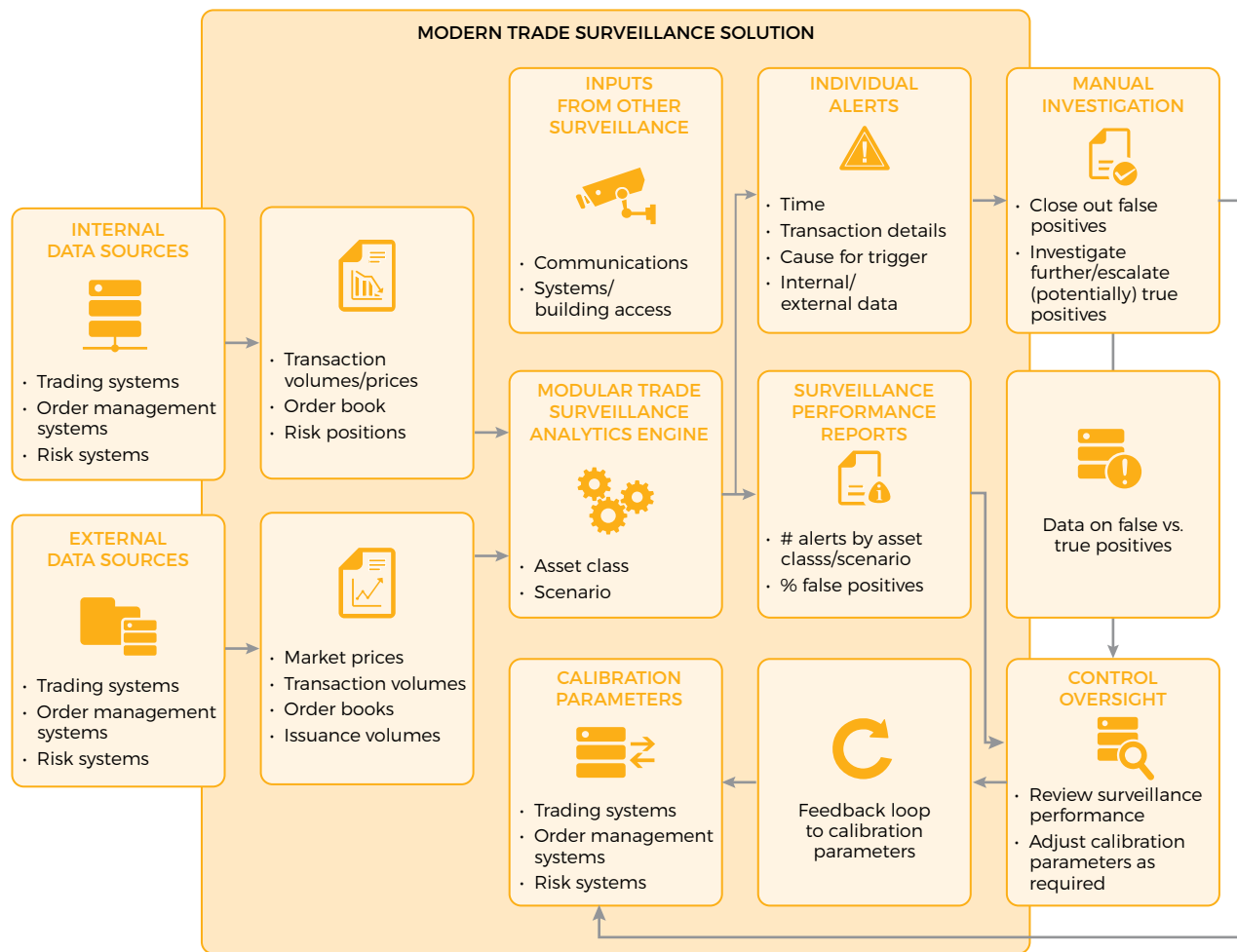
Effective surveillance in this environment relies on timely access to a wide range of order and post-trade data to build a holistic view of market activity. Data types include market announcements, order activity, and price changes for appropriate analysis.

We see two key developments occurring here:

Creating a coherent market overview: Enabling a more comprehensive view of market activity is essential to detecting and mitigating disruptive market events. This would trace trading activity from trade ideation to trade placement, routing, and execution and would empower market participants to draw linkages from multiple data types/sources both internally and externally to improve surveillance. The complexity of achieving this task in a standardized manner should not be under-estimated, given the sheer volumes of data and standardization requirements. However, we have seen significant progress on this front in several jurisdictions.

Leveraging new technology for real-time surveillance: As technology advances and there are further developments in the fields of AI, machine learning, and big data, there exists the potential for (near) real-time surveillance with integrated functionality across trading floors, trading markets, and regulators. While this will require significant investment, it is the natural progression of surveillance mechanisms to employ these capabilities to quickly form a holistic view of events. These technologies could be deployed across multiple venues with the potential to halt trading (across a particular security/asset class or just a single trader/firm) if early signs of a disruptive market event or cascade effect is detected. However, we note that the ability for any such solution to be deployed across markets would rely on the agreement of all venues, strong data protection standards (potentially leveraging a third-party utility like institution for processing), and/or a regulatory mandate.

Exhibit 8: Real-time trade surveillance solution



We believe these developments can help to address irregular trading and pricing, and to identify anomalies in trading and extreme volatility that pose a threat to the stability and integrity of financial markets. We anticipate that the results will not merely be better identification of such events, but also more rapid or real-time assessments that could support circuit breakers and other tools more effectively.

Market Infrastructure firms have already proactively begun investing in these developments, which is promising. For example, US exchanges are moving towards a Consolidated Audit Trail (CAT) which will allow regulators to consolidate data from SROs, broker-dealers, and other market participants to aggregate it for the purposes of tracking, analyzing, and investigating trading activities across the market. The CAT was initially envisaged to support real-time reporting, however the complexity of achieving this has seen it redesigned without real-time capabilities. Nevertheless, the CAT is expected to be highly valuable in supporting piecing together of events leading to market irregularities such as flash crashes. In addition, third-party surveillance solutions, such as SMARTS, now offer solutions for real-time surveillance of trade activities to instantly detect violations.

The ambitions of today's technologies are far-reaching including the potential to support improved surveillance. While we see technology being deployed to support real-time surveillance, the inherent complexities discussed mean we may still be far from realizing this ambition.

INTERACTIVE, OUTCOME-ORIENTED SUPERVISION

In the past, supervision by MIs has been rules-based, with a specific set of regulations laying out what market participants must and must not do. However, this model is being challenged by the growing breadth of supervisory activities that MIs need to provide, given the complexity and rising volumes of cleared activity. The scale of supervision requires MIs to interact on a day-to-day basis with supervised entities, leading to a more interactive supervisory approach. Furthermore, maintenance of effective market integrity calls for an ecosystem-level view. As the role of MIs in the new supervision environment become more important, effective supervision will need to rely increasingly on localized models, which can only be enforced by market participants.

We see two key developments occurring:

Introduction of elements of outcome-oriented/principles-based policy design:

Alongside today's rules-based architecture, we see more principles-based elements of policy design being introduced. This will not undermine the continued strengthening of the rules-based system, but help reinforce it.

Greater dialogue across the industry: Codifying responses to components of policy design will take time, and industry working groups will be essential in developing and sharing best practices.

Regulators and MIs are already collaborating to enhance policy design and supervisory efforts in an interactive manner. For example, the CFTC Market Risk Advisory Committee holds public meetings on enhancing risk management efforts and the SEC Equity Market Structure Advisory Committee does something similar. EMIR-authorized CCPs have their own clearing members as part of their risk committees as do CCPs in other jurisdictions.

5 CONCLUSION

MIIs are undergoing an evolution. This transformative process is calling on them to fulfil their core function of maintaining market integrity, driving economic growth and managing risk, while rising to new challenges from the market, technology, and society at large. On the one hand, this represents a challenge, both in terms of their capabilities and their investments; on the other hand, it presents an opportunity to take on a more significant role and take on a more significant role adding value to the industry.

The changes we have outlined are significant, and will require a robust, proactive approach. Incumbents will need to move quickly, or else risk losing share to innovative competitors. We see MIs pursuing the following agenda:

- Bold investments in new technologies (such as AI and pattern recognition) to support enhanced market integrity capabilities, including the development of (near) real-time monitoring to spot market abuse
- Taking a leading role in creating opportunities to collaborate across MIs, regulators, and market participants to support market integrity, such as centralized monitoring to assess activity across venues or cross-CCP credit-risk monitoring
- Focus on continuous improvement and digitization of risk-management and compliance frameworks and tools
- Continued enhancement of supervisory functions, including the creation of specialist teams with a combination of expertise from data analytics to front office experience

We expect that the financial markets industry will need to spend up to US\$3–4 billion to realize this agenda in the next five years with roughly 40 percent of this investment being undertaken by MIs (some of this investment is already underway). Our estimate is based on reviewing industry-wide spending on recent major regulator and market integrity related transitions including the implementation of the Consolidated Audit Trail in the US, and MiFID II which was centered in Europe but had global implications³⁴. The expenditure estimates are incremental, and include upgrades to industry infrastructure as well as the development of new capabilities to address the trends outlined.

Other stakeholders throughout the financial markets ecosystem will need to evolve to succeed in an environment of new expectations and market dynamics. They should be prepared to focus on these key points:

- Policymakers and regulators must balance the role of MIs as regulatory partners, while being entities that are accountable to their owners, stakeholders, and end users
- Issuers will be expected to meet new standards of governance and multi-stakeholder accountability
- Finally, market participants, investors, and end users should partner with MIs to streamline solutions and reduce costs in the system

³⁴ SEC, "Rule 613 (Consolidated Audit Trail)" (October 2012)

APPENDIX

This report draws extensively on WFE and Oliver Wyman expertise, as well as primary research and survey responses from WFE members. A number of senior executives from exchanges, MIs, and regulators have been interviewed to lend additional perspectives to the report. Details on the survey and interviews are contained in Appendix B.

APPENDIX A: FUNCTIONS OF AN EXCHANGE AND A CCP

WHAT IS AN EXCHANGE?

Exchanges provide a secure, regulated, centralized infrastructure for the listing and trading of financial instruments. They thereby provide an ecosystem for financing the real economy.

Stock exchanges provide facilities for firms to raise capital within the primary market, and facilitate the buying and selling of equity shares and other equity-like instruments on secondary markets.

Companies wishing to raise capital through primary markets, and list on the stock exchange must publish an audited prospectus, setting out their governance structures, financial position, business model, and the risks to future success. They are also required to comply with certain minimum requirements relating to the number of shares they make available and the number of shareholders they have at the time of listing. The ability for enterprises to raise capital and thereby contribute to economic development is one of the positive social benefits of these institutions provided by exchanges; this topic is explored in-depth in the WFE/UNCTAD paper *The Role of Stock Exchanges in Fostering Economic Growth and Sustainable Development*.

Secondary markets not only allow for the buying and selling of shares, but that very process also determines the market value of shares. This in turn can be extrapolated to calculate the valuation – known as market capitalization – of public companies. This price-discovery mechanism is a unique attribute of exchanges, as prices are publicly reported, making the performance of public companies transparent to investors and the broader society. A central marketplace in which to buy and sell shares reduces the cost for investors of having to attempt to find a buyer/seller on a bilateral basis. The ability to buy and sell shares easily on liquid markets lowers the cost of (equity) capital for firms, as the more liquid an asset is, the less illiquidity premium investors demand for holding it. Liquid assets are desirable to investors who may require liquidity at short notice.

Derivatives exchanges facilitate trading in financial instruments that derive their value from an underlying asset. Derivatives contracts can be structured as futures or options, where the future gives rise to an obligation to buy or sell the underlying asset at a predetermined price in the future, while the option grants a right to buy or sell. Financial derivatives may be linked to currencies, interest rates or credit risks; other derivatives may be linked to commodities or securities. Beyond these common derivatives, contracts may be linked to a great variety of other assets or indices, tracking things like the volatility of the stock market, the weather in a particular region, or the cost of freight transport. Firms that are exposed to the risk of a movement in the price of these assets, may use derivatives to manage this risk. The counterparties to these contracts may be businesses with opposite risks, speculators who take view on the future price of underlying assets, arbitrageurs who sew together fragmented markets or market-makers who hold assets in inventory and profit from the bid/ask spread.

Global exchanges vary enormously in terms of instruments traded, corporate structure, and geographical coverage. Many are frontline supervisors of their markets, sharing many regulatory objectives tasks with market authorities, though the extent and nature of the regulatory responsibilities will vary depending on the relevant legal and regulatory framework. Regulatory duties are likely to include responsibility for rulemaking associated with listing, ongoing company disclosure, trading, market participants' behavior, and the penalties associated with market abuse. Surveillance duties include monitoring for market abuse, preserving orderly trading during periods of stress or material news, and enforcing rules of the market such as position limits.

Increasingly, exchanges provide a range of services including market data (e.g. feeds and analytics), benchmarks and indices, compliance solutions (e.g. trade reporting), technology solutions (e.g. for high-speed trading or best execution), corporate services and the publication of regulated disclosures. Exchange groups may also include entities that provide clearing and settlement services.

WHAT IS A CLEARINGHOUSE?

Clearinghouses are institutions that manage risk associated with markets in financial instruments. As there is typically a lag between when a trade occurs and when the transaction settles, clearinghouses exist to manage the risks that may arise in this post-trade/pre-settlement period. While all sorts of financial instruments (including company shares) are cleared, the clearing of derivatives is particularly important due to their unique characteristics. Whereas securities transactions are typically settled within two days, derivatives contracts such as futures and options usually have a longer period between the agreement of a contract and its settlement.

Clearinghouses help to manage risk by:

- Substituting themselves as counterparty to each transaction becoming the buyer to every seller and the seller to every buyer
- Setting rigorous financial and operational requirements for entities acting as members of the clearinghouse (the counterparties to the transaction)
- Implementing a risk model which requires clearing members to deposit collateral with the clearinghouse to ensure the clearinghouse has sufficient funds to manage the default of a participant. This takes the form of:
 - Initial margin, which is calculated daily according to the value of a member's open positions, and ensures that members are able to meet their obligations, and
 - Variation margin in the case of significant changes in the value of open contracts

CONTRIBUTION TO A DEFAULT FUND

Setting out clear rules for the use of member and clearinghouse collateral and the management of a default (often referred to as a default waterfall). Typically, if a counterparty defaults on its obligation, the clearinghouse will seek to close-out or auction its positions. Any further loss would be cushioned by the defaulting member's margin. In the rare event that a significant default, or series of defaults, exhausts the posted margin collateral, the clearinghouse will access the defaulting member's contribution to the default fund, its own contribution and then only as a last resort, the contribution of non-defaulting members and possibly a request for additional contribution – known as the mutualization of losses.

One way clearinghouses manage their balance sheets is to offset the risks associated with different trades against one another – known as netting. The more trades are netted against one another, the more clearinghouses can reduce margin requirements for clearing members. It is therefore common for clearing services to be concentrated in a single clearinghouse on a product-by-product basis as that ultimately reduces the cost for users without a resulting increase in risk.

Clearing financial transactions, particularly derivatives contracts, enhances transparency and the ability of prudential regulators and central banks to monitor these markets, including counterparties' risk exposures and interconnectedness. The default of a counterparty to a series of derivatives transactions can have repercussions that reverberate throughout the economy, as demonstrated during the GFC. For this reason, global policymakers have encouraged and even mandated that many derivatives contracts be cleared, including over-the-counter (OTC) derivatives, which are not traded on exchanges. The greater use of clearinghouses post-crisis has meant greater concentration of activity in clearinghouses and an enhancement of resilience planning for periods of market stress.

APPENDIX B: DETAILS OF SURVEY RESPONDENTS AND INTERVIEW

Exhibit 9: Case studies

ORGANIZATION	NAME
Athens Stock Exchange (ATHEX)	Dr Nikolaos Porfyrakis, Phd, Chief Business Development Officer
B3 – Brasil Bolsa Balcão	Maiara Madureira, Issuer Regulation Manager
Deutsche Börse AG	Sujata Wirsching, Group Regulatory Strategy
Hong Kong Exchanges and Clearing	Ryan Ingram, Group Regulatory Analytics, Risk Policy & FMI Strategy Ketan B. Patel, Deputy Group Risk Officer
Japan Exchange Group, Inc.	Hirofumi Takahashi, Deputy Chief Representative in Europe
Johannesburg Stock Exchange	Anne Clayton, Head, Public Policy
Saudi Stock Exchange (Tadawul)	Roland Bellegarde, Senior Advisor to the CEO

Exhibit 10: Stakeholder interviews

ORGANIZATION	NAME
Allianz Global Investors	Eric Boess, Global Head of Trading
Bank of England	David Bailey, Director, Financial Market Infrastructure Directorate
BlackRock	Stephen Fisher, Managing Director, Global Public Policy Group Joseph Garelick, Vice President, Risk and Quantitative Analysis Sander van Nijlen, Managing Director, ETF and Index Investments
Centre for European Policy Studies	Karel Lanoo, CEO
Citi	Howard Miller, Director, Global Government Affairs
European Commission	Patrick Pearson, Head of Financial Markets Infrastructure, DG-FISMA
European Central Bank	Marc Bayle de Jessé, Director General, Market Infrastructure and Payments Fiona van Echelpoel, Deputy Director, General Market Infrastructure and Payments Simonetta Rosati, Head of Section, Directorate General Market Infrastructure and Payments
Goethe University of Frankfurt	Professor Dr Peter Gombert Chair of e-Finance
White & Case	Matthew Griffin, Partner

Exhibit 11: Strategic survey respondents

EXCHANGE	EXCHANGE
Amman Stock Exchange	Johannesburg Stock Exchange
Australian Securities Exchange	Luxembourg Stock Exchange
B3 – Brasil Bolsa Balcão	Moscow Exchange
Bermuda Stock Exchange	Palestine Exchange
Bolsa de Valores de Colombia	Philippine Stock Exchange
Bolsa de Valores de Lima	Saudi Stock Exchange (Tadawul)
Bolsa Mexicana de Valores	Shenzhen Stock Exchange
BSE India Limited	SIX Swiss Exchange
Bursa Malaysia	Stock Exchange of Mauritius
Cboe Global Markets	Taiwan Futures Exchange
Colombo Stock Exchange	The Egyptian Stock Exchange
Cyprus Stock Exchange	The Options Clearing Corporation
Dubai Financial Market	The Stock Exchange of Thailand
Hochiminh Stock Exchange	TMX Group Inc.
Hong Kong Exchanges and Clearing	Zhengzhou Commodity Exchange
Japan Exchange Group, Inc.	

Exhibit 12: Regulatory survey respondents

EXCHANGE	EXCHANGE
Abu Dhabi Securities Exchange	Johannesburg Stock Exchange
Amman Stock Exchange	Kazakhstan Stock Exchange
Athens Stock Exchange (ATHEX)	Moscow Exchange
B3 – Brasil Bolsa Balcão	National Stock Exchange of India Limited
Bolsa de Comercio de Santiago	Nigerian Stock Exchange
Bolsa de Valores de Colombia	Oslo Stock Exchange
Bolsa Mexicana de Valores	Palestine Exchange
Borsa İstanbul	Saudi Stock Exchange (Tadawul)
BSE Limited	Shanghai Futures Exchange
Bursa Malaysia	Shenzhen Stock Exchange
Cboe Global Markets	SIX Swiss Exchange
Colombo Stock Exchange	Stock Exchange of Mauritius
Deutsche Börse AG	Taipei Exchange
Dhaka Stock Exchange Ltd.	Taiwan Futures Exchange
Dubai Financial Market	Tel-Aviv Stock Exchange
Irish Stock Exchange	The Egyptian Exchange
Japan Exchange Group Inc.	The Stock Exchange of Thailand

AUTHORS

WFE	OLIVER WYMAN
Nandini Sukumar CEO, The WFE	Daniela Peterhoff EMEA Co-Head of Corporate & Institutional Banking and Global Head of Market Infrastructure
Siobhan Cleary Head of Research and Public Policy, The WFE	Aarti Nihalani Partner, India
Richard Fenner Regulatory Affairs Manager, The WFE	Quinton Goddard Principal, London
Stefano Alderighi Senior Economist, The WFE	Shasheen Jayaweera Principal, New York

REPORT STEERING COMMITTEE

ORGANIZATION	NAME
Abu Dhabi Securities Exchange	Rashed A. Al Blooshi , Chief Executive
Borsa İstanbul	Recep Bildik , Director, Research and Business Development
BSE India Limited	Piyush Chourasia , Chief Risk Officer & Head Strategy Indian Clearing Corporation Limited
Bursa Malaysia	Azalina Adham , Chief Operating Officer
CBOE Holdings, Inc.	Angelo Evangelou , Chief Policy Officer
Deutsche Börse AG	Sujata Wirsching , Group Regulatory Strategy
Johannesburg Stock Exchange	Anne Clayton , Head, Public Policy
London Metal Exchange Ltd. (LME)	Kirstina Combe , Head of Regulation, Risk and Compliance
Nasdaq	Andreas Gustafsson , Senior Vice President and Chief Counsel Europe
Oliver Wyman	Daniela Peterhoff , EMEA Co-Head of Corporate & Institutional Banking and Global Head of Market Infrastructure
SIX Swiss Exchange	Ian Cornwall , Director, Head Market Structure
Stock Exchange of Mauritius	Vickram Ramful , Head of Listing
The Depository Trust & Clearing Corporation	Michael W. McClain , Managing Director, General Manager, Equity Clearing

ACKNOWLEDGEMENTS

The authors would like to acknowledge the contribution of the full team involved in the preparation of this report. We are grateful to the Oliver Wyman team members (Katrina Bowen, Korbinian Krainau, Tanishq Goyal and Arnav Gupta and The WFE's Padmasai Varanasi for their contributions. We are also thankful for the support from Oliver Wyman's design-translation-production team who helped us put our ideas into visuals. Lastly, we are grateful for the support of The WFE's Anna Watson and Oliver Wyman's marketing team for their guidance throughout this process.

ABOUT OLIVER WYMAN

Oliver Wyman is a global leader in management consulting that combines deep industry knowledge with specialized expertise in strategy, operations, risk management, and organization transformation.

For more information please contact the marketing department by email at info-FS@oliverwyman.com or by phone at one of the following locations:

AMERICAS

1 212 541 8100

EMEA

44 20 7333 8333

ASIA PACIFIC

65 6510 9700

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