

Response

IOSCO CONSULTATION REPORT - CR03/2020

MARKET DATA IN THE SECONDARY EQUITY MARKETS



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ICSA is the global organization of securities industry associations representing securities firms operating in domestic and cross-border markets across the globe, including East and West Asia, Latin America, North America, and Europe.

ICSA advocates appropriate regulatory policies and regulations, policy approaches and techniques across jurisdictions, and public policy initiatives to promote efficient and well-functioning securities markets, and the efficient flow of cross-border capital in global capital markets. Appropriate regulatory initiatives should assist in leading to increased confidence and efficiency in the markets. These initiatives should also assist in increased economic growth, benefiting markets participants and the general health of global capital markets.

ICSA provides a forum for member associations to understand market and industry developments across indigenous and cross-border markets, exchange views on the conduct of regulatory and public policy in domestic markets, and collaborate for more efficient capital markets. ICSA assists regulators and government authorities in understanding the global, consolidated and non-biased position of industry as it relates to proposed policy and regulatory reform initiatives in global capital markets. www.icsa.global

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The Global Financial Markets Association (GFMA) represents the common interests of the world's leading financial and capital market participants, to provide a collective voice on matters that support global capital markets. We advocate on policies to address risks that have no borders, regional market developments that impact global capital markets, and policies that promote efficient cross-border capital flows to end-users by efficiently connecting savers and borrowers, benefiting broader global economic growth.

The GFMA brings together three of the world's leading capital markets trade associations to provide a forum for the largest globally active financial and capital market participants to develop standards to improve the coherence and interaction of cross-border financial regulation. We aim to improve the functioning of global capital markets to support global economic growth and to support lending and to serve clients in those jurisdictions they want to do business.

The [Association for Financial Markets in Europe](#) (AFME) in London, Brussels and Frankfurt, the [Asia Securities Industry & Financial Markets Association](#) (ASIFMA) in Hong Kong and the [Securities Industry and Financial Markets Association](#) (SIFMA) in New York and Washington are, respectively, the European, Asian and North American members of GFMA. www.gfma.org

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Response to IOSCO Consultation Report “Market Data in Secondary Equity Markets”

General comments

The Global Financial Markets Association (GFMA) and the International Council of Securities Associations (ICSA) welcome the IOSCO initiative to investigate market data issues via the consultation report “Market Data in Secondary Equity Markets”. We appreciate the opportunity to address the significant problem with increasing market data costs, which is a fundamental impediment for developing efficient, transparent and integrated capital markets. We note that global capital markets differ significantly in terms of market structure and therefore caution against a one-size-fits-all approach to this issue. Rather guiding principles would allow for valuable data to be provided to the markets at reasonable prices.

A key function of the financial system is to allocate capital and risk in a manner that supports economic development and growth, including through the provision of financing, investment and hedging products. The allocative function of the financial system is dependent on financial prices being set through an effective price discovery process, especially in the financial markets. This is in turn dependent, amongst other things, on the cost and quality of information that is available to financial market participants, including investors and securities issuers, who interact through the market process. Industry firms and their associations, regulators and standard setters like the International Organization of Securities Commissions (IOSCO) all share a common purpose in promoting the policy and business conditions under which financial markets can serve this purpose in the economy.

The fundamental function of exchanges is to match buyers and sellers of securities at a price that balances supply and demand through transparent rules and processes. The exchanges' sale of market data is a related but separate by-product of that primary function. The broker-dealers supply the bids and asks and are the origins of market data. The identification of the relevant instruments subject for bids and asks are made by the broker-dealers, not the exchanges.

Over the last few decades exchanges have greatly evolved in response to market forces and technological and regulatory developments. The privatization¹ of exchanges and market participants' implementation of best execution or fiduciary duty obligations has given exchanges significant market power with respect to market data unique to their trading venue, i.e. exchanges exercise significant market power in the supply of market data as market data cannot be substituted between trading venues. Given that market participants have best execution and/or fiduciary obligations to their clients, they are latency-sensitive and must obtain quotes and prices from exchanges, irrespective of cost if they want to stay in business, compliant with legal and regulatory requirements, and/or implement certain investment strategies, i.e. the demand for market data is inelastic.

Market data fees and restrictions are now determined by its increased demand and value, rather than by the fundamental costs of production as it should be. A fair analogy is the purchase of a laptop computer. The cost of the purchase is fixed and not determined by what the buyer can go on to achieve with it.

Globally, exchanges utilize their market power with the consequence of limiting market data access, data distribution and competition. The negative effects of increased market data costs are widely recognized, including by supervisory authorities.²

¹ In some countries/regions it is more correct to use the phrase “demutualization” rather than “privatization” as governments did not own the exchanges. However, in this memo, the term “privatization” is used generally for simplicity reasons.

² See ESMA report from 5 December 2019 in response to the market data consultation https://www.esma.europa.eu/sites/default/files/library/mifid_ii_mifir_review_report_no_1_on_prices_for_market_data_and_the_equity_ct.pdf.

The consequences of the increasing market data costs force many data consumers to scale back their data purchase to a minimum and sometimes, economically suboptimal level, deselecting certain investments or markets. This results in reduced transparency, decreased levels of cross-border competition and lower market integration. The consequences of these outcomes are less informed markets, weaker competition, and higher costs for investors and potential higher cost of capital for, in particular, smaller companies.

Because of the regulatory requirements related to market data, there should be a regulatory interest in ensuring that market data fees and licensing practices are fair and reasonable and not a burden on competition. Our suggestions for ensuring this are elaborated in particular in our response to Q5 below.

In June 2020, ICSA, EFAMA and MFA published "Global Memo: Market Data Costs" to highlight continuing increases in market data costs and their negative effects on capital markets. The paper recommends that governments, regulators, central banks, and standard setters establish core principles to address the problem. Authorities should recognize that exchanges hold disproportionate market power on market data. Costs (market data pricing, licensing practices, definitions, audit procedures and connectivity fees) should be subject to more rigorous regulatory oversight.

The paper (with extensive links and references to data) can be accessed at <https://icsa.global/sites/default/files/Global%20Memo%20on%20Market%20Data%20Costs%20-%20June%202020%20.pdf>

GFMA and ICSA have the following specific comments to the consultation

Specific comments

Q1: Please identify the data elements that are necessary for investors and/or market participants to participate effectively and competitively and make informed trading decisions in today's markets. In your response, please consider:

- **The type of investor (e.g. retail or institutional) that uses the data;**
- **How orders are sent to a trading venue (e.g. electronic, manual, direct access by clients; and**
- **How orders are routed**

Please provide the reasons why each element is necessary.

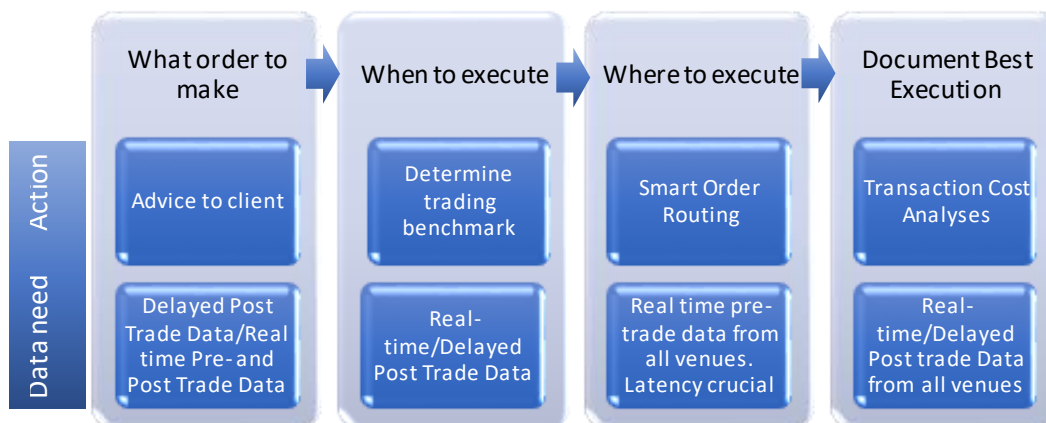
Having access to real time market data from multiple exchanges/trading venues is crucial for financial market participants, whether acting on their own behalf or on behalf of clients. Data access is also indispensable for market participants to carry out their core business as illustrated in figure 1. Frequently, exchanges have the dominant market share for stocks listed with them. However, regardless of where a stock is listed, all exchanges are in the unique position of being the only entity in a position to provide pricing information for their market with the least amount of data latency. Given that market participants effecting client orders have best execution and/or fiduciary obligations to those clients and are latency-sensitive, they must obtain quotes and prices from exchanges - irrespective of cost - to stay in business. This data is required for compliance with legal and regulatory requirements and/or implementation of investment strategies.³ Data is used to determine what order to make, when to execute, where to execute and to document best execution. This need from market participants for specific and non-substitutable market data provides exchanges with the power to behave independently of other exchanges and of their clients.

Trading firms without clients are also compelled to obtain low-latency proprietary exchange data in order to stay competitive. Where trading profits are won and lost in milliseconds or microseconds and depend on detailed order-by-order market data, the only realistic choices are to pay for the data or exit the business.

see actions taken by SEC: <https://www.sec.gov/news/public-statement/statement-chairman-clayton-2018-10-16>). And in Canada the authorities are following SEC; <https://insurance-journal.ca/article/rising-market-data-costs-raising-operating-costs/>

³ Regulations, such as the US order protection rule, require trading centers to adopt policies and procedures to prevent trades at prices worse than a protected quotation. In EU, US and Canada, best execution requirements and investment management fiduciary duty obligations, have created a framework where market participants—whether broker-dealers/investment firms or investors—are compelled to purchase exchange data to meet legal, regulatory, and competitive standards

Figure 1. Why is market data important?



Note: Market data is 1) generated as a unique by-product of the activities taking place in relation to trading,⁴ 2) contains fundamental information indispensable for agents' ability to participate in trading (for example the current market price and current orders for a certain security), and 3) necessary to satisfy regulatory requirements, such as best execution, order protection and/or fiduciary duty obligations as illustrated in figure 1.

Source: Copenhagen Economics (2013) + own additions.

Due to the regulatory requirements and the expected level of advice in a trading situation, a market participant with trading discretion such as a broker/dealer acting on behalf of a client must make decisions regarding 1) when to trade an order during the day, and 2) where to execute an order at the lowest/highest price. To evaluate the best strategy, the broker/dealer must have access to a variety of different elements of market data, including both pre- and post-trade data. If the required data is not available and timely, the execution of the trade may not be optimal for the client.

As illustrated in figure 1, the institutional trading process can be divided into four steps: 1) what order to make, 2) what benchmark to trade against, 3) which venue to execute the order at, and 4) what strategy to execute the order optimally. In **step 1**, data requirements vary. In general discussions about market developments, delayed information is sufficient. However, for discussions about day-to-day trading of specific stocks, the broker/dealer and the client need access to real time pre- and post-trade data. For **step 2**, there will be a dialogue on what benchmark to trade against. When a large transaction is about to be conducted by a broker/dealer, avoiding market impact is crucial for the client. One strategy to avoid market impact is to split the parent order into child orders and execute it over time. A volume weighted average price (VWAP) trading benchmark which follows typical liquidity patterns can be used to time execution over the course of the day. To construct such a benchmark, both real-time and delayed post-trade data is needed to ensure the best result. **Step 3**: Once a trading benchmark has been determined, the broker/dealer must determine which venue(s) to execute the order. Several broker/dealers do this through a smart order routing system, which directs the order to the trading venue with the highest bid/offer. Such a system considers the depth of the order book and may split up the total order into smaller orders at different exchanges/trading venues. Broker/dealers that trade manually essentially perform the same task by using their deep order book overview in real time for all venues where the stock is traded (pre-trade data must be latency sensitive) to ensure compliance with fiduciary/regulatory requirements. **Step 4**: Post trade, it is important to evaluate whether the order was executed optimally. In particular, for large orders in particular, brokers must compile a transaction cost analysis (TCA) to determine the degree of effectiveness of the execution strategy. This analysis compares the timing and the venue of the actual trading with alternative behavior. To compile such an analysis, post-trade data from all venues where the stock might have been traded is required. While this description is generic to a large extent, this situation covers investors and broker/dealers in general.

⁴ Exchanges argue that market data and trading are joint products. They are not. The fundamental function of exchanges is to match buyers and sellers of securities at a price that balances supply and demand price through transparent rules and processes. The sale of market data is a related but separate by-product of that primary function.

There has been a regulatory recognition recently in the U.S. that investors need more than aggregated "top of book" round lot data to make trading decisions for equities.⁵ The US Securities Exchange Commission recently expanded the definition of equity core data from aggregated "top of book" round lot data to now include odd lot, auction imbalance and depth-of-book data, recognizing the importance of such data for trading decisions for retail and institutional investors. The SEC also changed the distribution of consolidated market data by allowing competing market data consolidators to replace the exclusive securities information processors ("SIPs"), which were controlled exclusively by exchanges that also sold faster and more comprehensive proprietary data feeds that competed with the SIP data. The SEC anticipates that this new competing consolidator model could lead to the tailoring of market data offerings based on the needs of each market data purchaser. For instance, brokers handling retail investors' orders could choose to subscribe to a consolidator that offers a data feed that includes only aggregated "top of book" round lot and odd lot data because its client base may not be interested in receiving information on the depth of book at the various exchanges. In this regard, when the retail investors are trading directly themselves through broker/dealers' online brokerage platforms (which is normal in the Nordic countries) they need direct access to at a minimum "top of book" data.

As outlined above, broker/dealers are subject to best execution obligations, requiring them to take all sufficient steps to obtain the best possible result for their clients when executing orders, considering factors such as, inter alia, price, cost, speed and likelihood of execution. Most institutional participants require pre- and post-trade data which facilitates best execution, transaction cost analysis and venue analysis.

Therefore, for institutional market participants utilizing electronic trading algorithms, depth of book information (such as the next 5 levels in the order book) and auction information (e.g., imbalance, IEP, IEV) also may be required from each of the exchanges in the market they operate in to create a holistic view of where liquidity lies. In the institutional context, especially for those with more complex order strategies, full depth of book information is often required from each of the relevant national exchanges.

Given the algorithmic and high frequency nature of many markets (in particular developed markets), latency is a key element of market data, as participants and their algorithms require real-time data that is not stale. This is particularly the case for participants following time sensitive strategies (e.g., high frequency traders) and institutional orders.

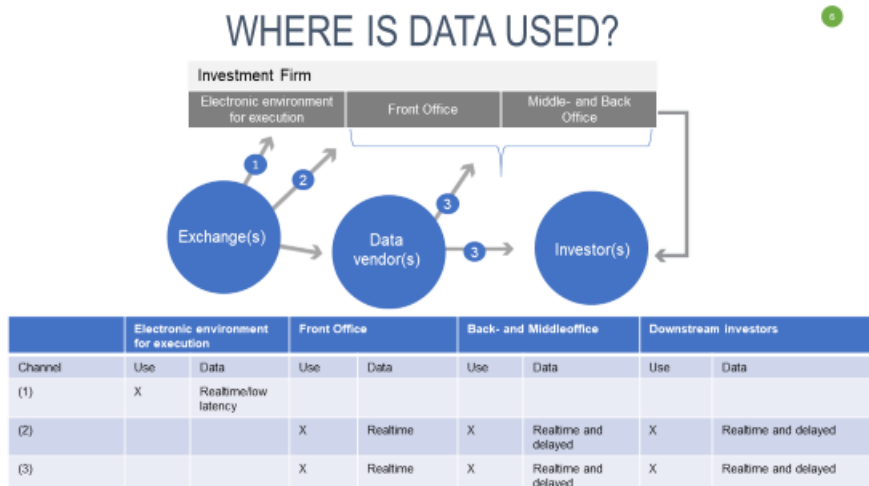
Additionally, many institutional investors and fund managers prefer and rely on execution benchmarks to track and compute execution quality. Therefore, market participants also require historical databases of intraday trading and quoting activity.

Q2: Are there other data elements that, while not necessary to all market participants, may be necessary for some market participants or business models? Please provide the reasons for your answer

The data from the different data channels are used for very different purposes even within the same consuming entity such as a broker or a large investor, cf. figure 2. Data from the direct feed from the Exchanges/trading venue through membership access (1) is used to execute transactions in an electronic environment. It is important that latency in data access is very low in order to achieve the best outcome on

⁵ A round-lot is currently understood in the U.S. as an order for 100 shares.

Figure 2.



each transaction. Data is being delivered in a very close to raw data format, which also helps to keep latency low as it does not have to go through a layer of processing before being delivered from the exchanges. Once trading algorithms have been programmed, executions are conducted electronically without any human ever seeing the direct feed data. The data is typically delivered fully bundled, divided only on asset class (equities, bonds, derivatives). Processed data from the trading venues (2) and (3) is used for staff functions from front to back office. Typical uses are to determine the trading strategy and document best execution/fiduciary obligations. Basically, everything appearing on a monitor within a broker/dealer or investor firm is purchased through (2) or (3). Rough estimates suggest that this data constitutes most data usage. While the front office of such firms typically uses real time data, middle and back office uses both real time and delayed data for many purposes. Many broker/dealers also have market surveillance teams who develop internal controls to ensure order executions stay within regulatory requirements, which requires pre- and post-trade data.

Depending on their strategies and market characteristics, not all investors require low latency connections, nor direct connections to exchanges for market data. However, many institutional investors seek full depth of book information to better inform their routing decisions and meet their regulatory obligation to achieve best execution. And while not all market participants require such (for example, retail), this data is indirectly required for all investors to achieve execution at a fair price.

Q3: Please share your view on defining Core Market Data and how such a definition can be used (for example, for compliance purposes or as a mechanism to make routing decisions, etc.).

The concept of Core Data is not consistently used globally amongst exchanges or in regulation. For example, it is well-defined in the US for equities and is not defined in APAC or Europe). In the US, Regulation National Market System requires exchanges to make core data available to a SIP. Until the SEC's recent rule discussed above, core data only included aggregated top of book round lot information (i.e., the best bid and offer in 100-share increments aggregated across all displayed markets). As noted above, the SEC recently redefined the definition of core data to reflect the evolving nature of trading and investors' need for more comprehensive data. The new definition now includes data such as auction imbalance, odd-lot and depth-of-book information.

From a regulatory perspective, the concept of Core Data does not currently exist in Europe. The closest analogy to 'core data' would be in relation to the set of pre- and post-trade data that is subject to the MiFIDII/MiFIR rules, which requires it to be provided on a 'reasonable commercial basis'. In other words, this 'core data' effectively defines the regulatory perimeter for the market data rules. This same information generally constitutes the data set that a consolidated tape provider would have to include in the tape. However, as a consolidated tape provider has not yet emerged in Europe, the consolidated tape framework

is expected to be reviewed and potentially revised during 2021 and is therefore still an open issue. Key issues, such as whether such a tape should include pre- or post-trade data are expected to be debated amongst European policymakers this year. As a result, caution needs to be exercised when seeking to define a core data set that is to be used globally as this will need to vary between regions and should also be permitted to vary depending on the local regulatory framework and regulatory purpose of the data.

From a practical perspective, our members define Core Data as the information required for participants to perform transaction cost analysis and venue analysis to make informed trading decisions and achieve best execution. Given its essential nature, it is important that Core Data is made available in a fair and reasonable manner with regulatory oversight. This implies that both real time and delayed Pre-and Post-Trade data to be Core Market Data, which we also may label as Raw Market Data. This data is indispensable for both trading purposes (including routing) as well as documenting best execution/fiduciary obligation, to fulfill order protection rules etc. Please also see our response to Q4.

Pre-trade data, which is data leading up to a trade, consists of bids and asks for different financial instruments, including the identification of the traded security (ISIN, etc.). Outside of the U.S., this is often divided into "level 1", which contains the top of the order book (i.e. best bid/ask) and "level 2", which includes Level 1 and the top 5 or 10 levels of the order book including the quantity available at each of these levels. The full order book is contained in what would be the "full depth of market" view, i.e. all bids and asks.

Post-trade data includes the identification of the traded security (ISIN, etc.), the price, the volume, and the time of the trade, i.e. the timestamp and the identification of the execution venue. Additionally, given the prevalence of benchmarks such as VWAP and TWAP, intraday and historical data is also required.

Many institutional investors seek full depth of book information to better inform their routing decisions and meet their regulatory obligation to achieve best execution.

Many market participants also require auction information (e.g., imbalance, IEP, IEV) from each of the exchanges in the market they operate in to create a holistic view of where liquidity lies in various sessions, as well as closing prices.

Many broker/dealers also have market surveillance teams which develop internal controls to ensure orderly executions stays within regulatory requirements, which requires pre- and post-trade data.

Other key trading information should also be published and disseminated – such as session information (volatility control mechanism flags, circuit breakers), uptick/downtick information (especially markets with the uptick rule for short selling), and auction information (e.g., the indicative equilibrium price, indicative equilibrium volume and imbalance information).

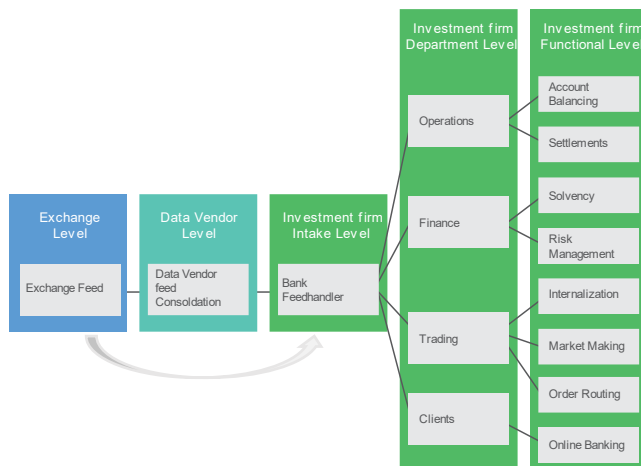
The data are often categorized by latency, which is the speed with which the market data is distributed to the user. The higher the speed, the lower the latency. Market data with low latency may have other applications than market data with higher latency. Indeed, market data with low latency may be crucial in achieving the best possible outcome on a trade, whereas market data with higher latency may be sufficient for ex-post analytical purposes. The exchange's data is indispensable for trading activities and cannot be substituted between exchanges (it is not possible to use data from exchange A to trade on exchange B).

Q4: How is market data used by different types of investors or different functions of your firm? Consider, for example:

- **Type of investor (e.g. retail or institutional)**
- **Trading Desks (proprietary or client-servicing including retail and institutional), Institutional, proprietary)**
- **Compliance**
- **Risk-Management**
- **Back office functions**

The use cases are numerous, cf. figure 3:

Figure 3. Use cases in a broker/dealer.



As also mentioned in our response to Q3, market data is used throughout the value chain. In the broker/dealer's Operations department, market data is used in many contexts such as account balancing and settlement, valuation and Fair Price adjustments, reconciliations, calculation of penalties in case of failure of settlement, product improvement, initial and variation margin calculation, securities lending, collateral management, credit-, counterparty risk calculation (OTC derivatives), audit oversight. The data requirement is a combination of real time and delayed data.

In the broker/dealer's Finance department, data is used for solvency and risk management, including but not limited to liquidity risk management, market risk management, credit- and counterparty risk (OTC derivatives), operational risk management, solvency calculations. The needed data will also be a combination of real time and delayed data.

For a broker/dealer's Trading department, there is a need for market data both in the pre-trade process of internalization, market making and order routing, which can include full order book data from all (relevant) exchanges, market data for pre-trade analytics – also for Smart Order Routers, price formation, block-size liquidity provision, trading strategy research, trade idea generation. The data is real time, latency sensitive data. Additionally, the Trading department also needs utility data for monitoring and risk checks and frontline support. Post trade wise, there is a need for data to perform Transaction Costs Analysis (TCA), analysis of block trades and analysis of provision of best execution/fiduciary obligation. The data requirements are a combination of both real-time and delayed market data.

Broker/dealers also have market surveillance teams which develop internal controls to ensure executions with within regulatory requirements, which requires real time pre- and post-trade data.

For Clients of the broker/dealer with direct trading access via the broker/dealer's system, there is a need for access to real-time data.

For asset management (not shown in the figure), the market data requirements include but are not limited to market data for asset allocation and transition management as well as data for portfolio construction, on-going monitoring and portfolio rebalancing. The market data requirements are a combination of real-time and delayed data.

For performance measurement and evaluation (not shown in the figure) the data needs include but are not limited to market data for calculation of the rate of return, index/benchmark creating and pricing, macro performance and pricing and macro performance attribution for both equities and fixed income. Delayed data will be sufficient for this purpose.

Finally, new regulatory requirements (not shown in the figure) may require market participants to buy additional market data licenses to comply with these requirements (e.g. new risk measures resulting from the Fundamental Review of the Trading Book - FRTB).

Please also beware of the considerable number of various market data users shown in figure 4 who all have significant (and increasing) requirements for market data for a number of purposes.

Figure 4. Who uses market data (an EU example)

Stakeholder Group	Industry Grouping	Indicative Number of Entities Europe inc. UK
Issuers	Issuers	9,430
End Investors	End Investors	15,500,000 (individuals)
Financial Intermediaries	Buy-Side	4,366 (plus 50k mutual funds)
	Sell-Side	10,576
	Trading Venues/APAs	430
Custodians/ Risk Managers	Custody, Clearing & Settlement	64
Regulators	Regulators	57
Data Analytics & Benchmark Providers	Data Analytics & Benchmark Providers	Not sourced or estimated
Other	Other	Not sourced or estimated

Source: Market Structure Partners (2020): The Study on the Creation of an EU Consolidated Tape

Q5: What impact does different uses have on the need to access data? How can these impacts be managed or addressed?

Please see our response to Q4 for the need for access to data for various use cases. Ideally, there should not be any kind of restrictions on data access and data usage so as to provide the best possible foundation for market participation.

With the limitations in mind, the data usages are dependent on each participant's strategy and business. For example, high frequency traders or participants with electronic execution strategies may require the full depth of book information and lowest latency possible.

Retail investors typically require at least top of book data that is provided by exchanges and consolidators depending on how they trade. Notably, with the SEC's proposal to expand the definition of core data, the SEC asserts that retail investors (or at least their broker-dealers) need more than top of book data.

The exchanges address current demand for depth of book data by selling it via proprietary feeds through a variety of connections and latencies (e.g., collocation, fiber or microwave networks, etc.).

The proposal to manage/address the problems with increasing market data costs is elaborated in the ICSA, EFAMA, MFA Global report on market data:

The fact that the business model for exchanges has changed necessitates a different approach in regulatory oversight. As IOSCO noted in its 2010 discussion paper on Stock Exchange Demutualization, “[t]here are a number of financial issues that may become of greater concern in a for-profit exchange”. Market participants globally believe that the day for greater concern has arrived.

Given that market participants are struggling globally from the burden of excessively high market data fees and unfair licensing provisions, global core principles should be established to address the problem. These principles would be adopted by jurisdictions, taking into account their unique legal and regulatory frameworks.

As a starting point, IOSCO should recognize that exchanges hold disproportionate market power on market data generated from orders and trades with respect to their venues. We have elaborated on this in our response to Q9. As such, market data costs (the market data pricing, licensing practices, definitions, audit procedures and connectivity fees) must be subject to supervisory scrutiny. Rigorous supervision of the entire market data ecosystem (as well as contiguous markets and products where the search for revenue could shift once there is increased scrutiny of market data sales) is crucial in order to maximize the economic benefits of financial marketplaces.

One crucial condition is that fees and other terms and conditions must **not** be based on demand as is the case to today but instead on the efficient cost of production and distributing the market data. Demand is inelastic (market data is indispensable for market participants) and exchanges have market power in supply (market data cannot be substituted between trading venues).

In order to address the structural issues contributing to the market data problem, IOSCO should consider developing a cost benchmark for producing and distributing market data, as articulated in the Copenhagen Economics reports from 2013, 2014, 2018 and 2019⁶ and the IEX report (January 2019).⁷ The IEX report is the first exchange report that contained detailed information on the cost of exchange services in the US. IEX published its report in response to the growing concerns around market data and connectivity fees and requests for transparency by US regulators and other market participants. In its report, IEX sets out details of the review it has conducted of its own costs to provide market data and connectivity compared with the fees NYSE, Nasdaq and Cboe charge for these products and services. Because of the regulatory requirements related to market data, there should be a regulatory interest in ensuring that market data fees and licensing practices are fair and reasonable and not a burden on competition.

The Core principles should entail

- 1. The price of market data and connectivity must be based on the efficient costs of producing and distributing the market data (as opposed to the value market participants derive from market data) with a reasonable mark-up. The cost should be measured against a recognised cost benchmark.**
 - a. Regulators should require trading venues to submit detailed cost and revenue data in order to understand the amount of mark-up exchanges impose.
 - b. As market data should be based on cost with a reasonable mark-up, exchanges should simplify contract terms and eliminate “non-display” categories. Instead, exchanges should consider simply differentiating between professional and non-professional users.

Please see IEX' cost study⁸ and Copenhagen Economics guideline to a cost benchmark⁹ for inspiration in addressing principle one in more detail.

⁶ <http://financedenmark.dk/the-danish-securities-dealers-association/publications/>

⁷ <https://iextrading.com/insights/cost-transparency-whitepaper/>

⁸ <https://iextrading.com/insights/cost-transparency-whitepaper/>

⁹ <https://www.copenhageneconomics.com/publications/publication/a-guideline-to-a-cost-benchmark-of-market-data-how-to-obtain-reasonable-prices-of-market-data>

2. **Trading venues of a single market system should standardize key market data contract definitions, terms and interpretations. Contract definitions, terms and policies should be specific and avoid overly broad or general terms.**
 - a. Market data licensing contracts should also avoid “derived data” terms, which are lopsided and unfair and instead should be governed by the general principle that licensing is provided on a fair, reasonable and non-discriminatory basis. Standardized agreements should be subject to regulatory review.
3. **Market data licensing contracts should be simplified to ease administration and so that audits are not necessary.**

Please see Appendix B and C for additional inspiration in respect of principle two and three in [Global Memo on Market Data](#).

In addition to considering cost benchmarks and core principles, it would be highly beneficial for IOSCO and securities regulators to fully engage with Competition Authorities. This would ensure that Competition Authorities are fully aware of the disproportionate market power of exchanges on market data and reinforce the need for action. IOSCO and securities regulators have a deep understanding of markets and data while Competition Authorities have expertise and responsibilities and certain powers in this area.

Further, having regard to our comments in response to Question 6 below, IOSCO should recommend that the contractual arrangements adopted by exchanges provide equivalent terms and conditions for all clients that use the same service and it should censure any practices that are discriminatory in this regard.

Q6: What factors should be considered in the context of evaluating “fair, equitable and timely access”? How should these factors be considered?

Market participants have different latency requirements for market data dependent on the participant's/client's investment strategy, as well as the profile of the market. High frequency and electronic trading strategies often require the lowest latencies possible. Low latencies are essential in developed markets such as in the US and EU (where such strategies are prevalent).

Exchanges offer methods of accessing market data at varying latencies (for example, collocation or microwave networks) to meet this demand. Members recognize that exchanges may reasonably include in their fees the costs associated with developing and supporting lower latency connections. This should remain, as not every market participant's latency requirements are similar. However, exchanges should not be discriminatory towards any subscribers in terms of fees charged for their desired data/performance, or the actual data/performance they receive, and should certainly not prevent certain market participants from accessing the available options.

Additionally, exchanges should not be selective on which types of data are available for market participants. In many aspects, exchanges are dominant and have, in some cases, used this position to prevent participants such as ETF providers from creating products by limiting their access to market data.

Given its importance to all market participants, market data must also be accurate and resilient. Market participants and algorithms require market data in order to operate. If data is unavailable, they will be unable to trade. This is also the case for exchanges where there are dual listings, as market data is not interchangeable. If one exchange's data is down while the other's is still operating, this may impact a participant's ability to trade and their ability to provide best execution.

With reference to our response to Q5, we believe that these factors of evaluating “**fair, equitable and timely access**” should include:

- Transparent, clear, unambiguous and reasonable market data policies and definitions, including audit terms¹⁰
- Transparent, clear, unambiguous price information, including comparison with past years' prices
- Transparent, clear, unambiguous cost of production to be able to assess the value of data vs price charged – see IEX report for cost examples¹¹
- Cost of production: Market data is a by-product of the primary function of an exchange, which is trading. Whenever orders are placed and executed, market data is automatically produced. This implies that the marginal costs of production are close to zero and the incremental costs associated with data production are limited to collecting the information and distributing it to customers. Present EU legislation allows that an appropriate share of joint costs **may** be included. However, definition of costs is lacking, and therefore it is impossible to compare and for supervisors to ensure enforcement. In the IEX report cost assessment is described including joint cost assessment. In the CE guideline, the construction of a cost benchmark for comparison and enforcement is elaborated using the IEX figures.
- Costs based pricing of market data and connectivity (and ports)
- A cost benchmark which shows the costs that may be included and which may serve as a benchmark and a tool for supervisors in their assessment on what is reasonable and whether the exchanges and other data providers comply with the requirements. Please see e.g. IEX report for which kind of costs that could be included in the assessment.
- Machine-readable data and no restriction in access
- No difference in latency if an exchange contributes to a consolidated tape – same latency on CT data as well as proprietary data.

Q7: What types of access do trading venues and RDPs provide? Are some forms of access provided only to specific market participants?

Per above, trading venues offer methods of connecting to its own venue's market data at varying latencies (for example, collocation, fiber optics and microwave networks) and speeds. Most exchanges offer 1Gb to 10Gb connections, although some developing markets exchanges or exchanges with legacy infrastructure may only offer connections such as 12Mbps.

Participants select the connections they need (again, based on the strategy and business they operate) and pay differently for each option. However, some of these methods and speeds may be lower or unavailable in certain developing markets or those with legacy infrastructure.

As mentioned, there have been instances where some exchanges have used their monopoly position to limit some participants' ability to receive and use their data.

In other instances, while some exchanges have officially prohibited participants from using certain technologies (e.g., microwave), the inability to properly enforce the regulation has led to an unequal playing field.

Please also see our response to Q2.

Q8: Please identify the type of access necessary for different investors and/or market participants to participate and make informed trading decisions in today's markets and the rationale for the type of access and identified differences. In your response, please consider:

¹⁰ Please see Appendix B and C for inspiration in respect market data policies, definitions and audits in the [Global Memo on Market Data](#). The response to Question 11 below provides further insights into the high cost of audits.

¹¹ <https://iextrading.com/insights/cost-transparency-whitepaper/>

- **Type of investor (e.g. retail or institutional)**
- **Trading Desk (Proprietary or client-servicing including retail and institutional)**
- **How orders are sent to a trading venue (e.g. electronic, manual, direct access by clients)**
- **Order routing**
- **Business models**
- **Compliance and regulatory issues**

Please see our response to Q2 and Q4.

Q9: What issues or concerns arise in the context of fair, equitable and timely access to market data?

The main concerns are related to:

1. The pricing of access to and use of market data,
2. The conditions for using market data (market data policies, including license administration and audits),
3. The various definitions and interpretations, causing license fragmentation and thereby increasing costs
4. Lack of transparency

As documented in several reports¹², exchanges increasingly have utilized their significant market power to charge excessively high fees and exercise unreasonable terms in their sale of market data generated with respect to their platform.¹³ Exchanges have increased market data fees in a number of ways, including changing the terms of licensing agreements, creating new categories of fees, redefining and re-categorizing fees, and forcing licensees to agree that the exchange has a licensing right in any work product derived from exchange data (so-called “derived data” terms). There are also concerns as to 1) participants being discriminated against in terms of the fees charged for their desired performance (latency), 2) actual performance received, and 3) inability of certain participants to access certain types of market data or connection methods.

For the reasons previously mentioned and given its importance to all market participants, market data must also be accurate and resilient. As market data is not interchangeable, one exchange's data going down while the other's is still operating may impact a participant's ability to trade.

The high and increasing market data costs are one of the unintended consequences and run contrary to the stated objectives of exchange privatization. The increased market data costs have also led to other significant negative consequences. For investors, the price of obtaining and using data constitutes a fixed cost of participating in a market – a fixed entry cost. When these costs increase, investors scale back their data purchase to a minimum. Certain investments or markets are deselected – usually smaller companies and smaller foreign markets. As a result, smaller investors may exit markets due to a lack of information with few new investors enter to replace them.

Similarly, for broker-dealers and investment firms, market data is a fixed entry cost. As the costs outpace the margin for providing execution services, more firms exit and fewer firms enter the business. The result is decreased competition and innovation in execution services and potentially a concentration in risk, which may exacerbate market conditions particularly in times of market stress or sudden spikes in market volatility.

A recent survey by IPUG and Cossiom based on 63 European buy- and sell-side firms found that 40-50 % of all data users scaled back their data purchase across regions, and 80 % knew of cases where financial institutions

¹² See e.g. Copenhagen Economics (2013, 2014, 2018, 2019), Expand (2019), Cossiom and IPUG (2019)

¹³ Running a stock exchange is one of the best examples of Economies of Scale. Once the trading venue has set up the trading facilities, rules, governance and so forth, there are almost no further costs, regardless of the number of transactions performed.

eliminated or curtailed investments, all in response to excessive market data costs. This is unfortunate as the core function of an exchange is to connect buyers and sellers and to serve as a market for capital formation and/or risk mitigation.

Market data from exchanges are indispensable for market participants to carry out their core business as shown in figure 1. Frequently, exchanges have the dominant market share for stock listed with them. However, regardless of where a stock is listed, all exchanges are in the unique position of being the only entity in a position to provide pricing information for their market with the least amount of data latency. Given that market participants have best execution and/or fiduciary obligations to their clients, they are latency-sensitive and must obtain quotes and prices from exchanges, irrespective of cost if they want to stay in business, compliant with legal and regulatory requirements, and/or implement certain investment strategies.¹⁴ Data is used both to determine what order to make, when to execute, where to execute and to document best execution. This need for market data by market participants provides exchanges with the power to behave independently of other exchanges and of their clients.

Trading firms without clients also are compelled to obtain low-latency proprietary exchange data in order to stay competitive. Where trading profits are won and lost in milliseconds or microseconds and depend on detailed order-by-order market data, the only realistic choice is to pay for the data or exit the business.

The strong position of exchanges in the economy is similar to companies in sectors operating essential economic infrastructure, e.g. power and telecommunication grids, airports and railways. When essential economic infrastructure is privatized, regulatory requirements are normally imposed to ensure their market power is not abused. Counterbalancing regulation has been partially implemented for exchanges. However, over time it has become more and more challenging for exchange supervisors to clearly ascertain the cost and profit from producing and disseminating market data given competitive and profit incentives for exchanges to unbundle and increase the complexity of product offerings and to group (for public and regulatory reporting purposes) profit and loss for multiple exchange functions such as trading, surveillance and other technology-based services. As such the regulatory requirements and/or supervisory oversight has not been effective in controlling costs.¹⁵

In addition to exploitative prices, exchanges engage in predatory practices by imposing unfair and unreasonable terms of use on market participants/licensees. As firms need exchange market data, they have little choice but to sign the exchange market data licensing contracts. These contracts typically include overly broad terms and definitions; "derived data" provisions, stipulating that the exchange has a licensing right in any work product derived from exchange data and may charge a separate derived data fee;¹⁶ and "non-display" provisions, charging users for each separate software/machine-use of data. Under these provisions, oftentimes market participants pay multiple licenses for usage of the same data. Further, licensees are subject to intrusive and burdensome audits, with no recourse for unfair findings and punitive fees as they risk exchanges disconnecting market data feeds which would jeopardize the licensee's business. This is especially problematic as exchanges use ambiguous and vague definitions in their market data licensing contracts, which allow auditors to easily cite unauthorized data usage and charge backpay and interest. Such predatory practices with the involving of audits can be used to extract greater market data revenue from market participants.

Market participants are concerned that exchanges are charging excessive fees and imposing unfair licensing terms. First, exchanges have increased market data and related fees (i.e. connectivity fees) significantly over

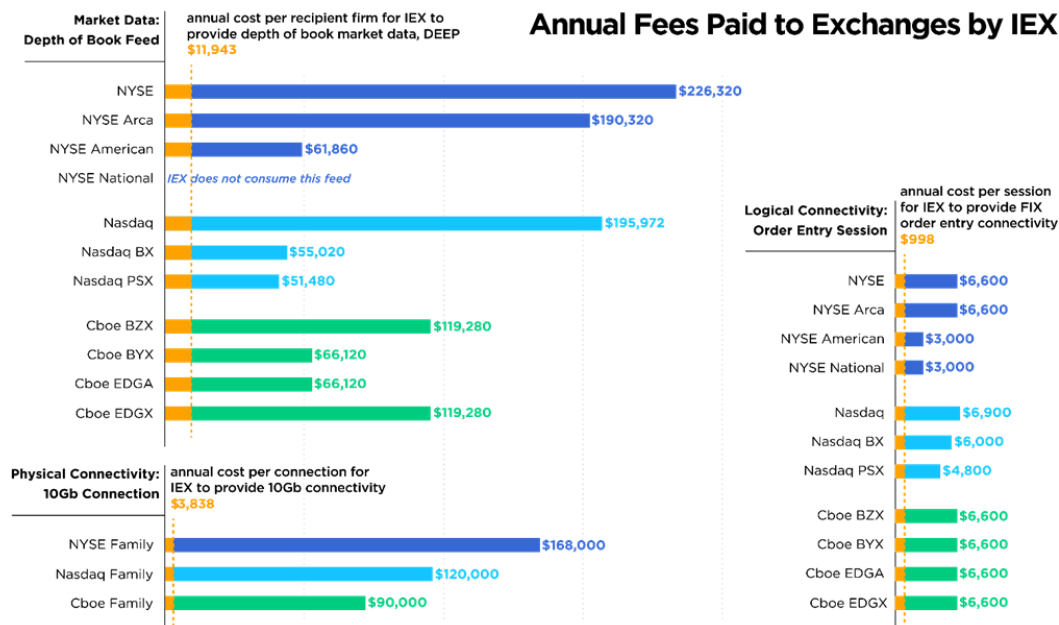
¹⁴ Regulations, such as the US order protection rule prohibiting trades at prices worse than a protected quotation. In EU, US and Canada, best execution requirements and investment management fiduciary duty obligations have created a framework where market participants—whether broker-dealers/investment firms or investors—are compelled to purchase exchange data to meet legal, regulatory, and competitive standards.

¹⁵ See e.g. ESMA report from 5 December 2019 in response to the market data consultation https://www.esma.europa.eu/sites/default/files/library/mifid_ii_mifir_review_report_no_1_on_prices_for_market_data_and_the_equity_ct.pdf

¹⁶ As a consequence, exchanges use the derived data provisions to subject users to intrusive audits, potentially exposing trade secrets and other intellectual property.

a relatively short span of time without sufficient justification.¹⁷ Second, market data fees have continued to increase year after year while global computing and storage costs continue to decline. Third, estimates on the cost to aggregate and produce market data indicate that exchanges are charging fees several hundred times above the cost. Figure 5 below shows an estimate of the annual cost per recipient for U.S.-based Investors Exchange (IEX) to provide depth of book market data compared with what other U.S. exchanges charge for such data.

Figure 5. Annual fees paid to exchanges by IEX



Q10. Please share your view on interchangeability of market data between trading venues. If concerns are identified, please provide suggested mechanisms to address them

Certain data is unique per trading venue, and you cannot use data from trading venue A to trade on trading venue B.

So, in this context, for trading purposes there is NO interchangeability between venues. There is no competition in market data and the incumbent exchanges hold a dominant position. As the market data from each exchange is indispensable for the data users (the demand is inelastic), the exchange can set the prices and conditions for using the market data as they see fit, which is also what empiric evidence reveals, cf. our response to Q9.

In the U.S., while current core data is helpful, it lacks the granularity from each exchange required by many participants to create a consolidated view of the market. As a result, market participants are forced to purchase proprietary data feeds from individual exchanges in order to create a robust consolidated view of

¹⁷ <https://www.sifma.org/wp-content/uploads/2019/01/Expand-and-SIFMA-An-Analysis-of-Market-Data-Fees-08-2018.pdf>, <https://www.thetradernews.com/market-data-justifying-the-cost/>; <https://www.wsj.com/articles/sec-to-rule-nyse-nasdaq-didnt-justify-market-data-fee-increases-1539721232>; <https://www.ft.com/content/3d176bd4-d0be-11e9-b018-ca4456540ea6>; <https://www.bestexecution.net/data-management-market-data-heather-mckenzie/>; <https://www.sec.gov/news/public-statement/statement-chairman-clayton-2018-10-16>; [Copenhagen Economics reports and guideline](https://www.esma.europa.eu/sites/default/files/library/mifid_ii_mifir_review_report_no_1_on_prices_for_market_data_and_the_equity_ct.pdf), https://www.esma.europa.eu/sites/default/files/library/mifid_ii_mifir_review_report_no_1_on_prices_for_market_data_and_the_equity_ct.pdf

the market. In the EU, it is sufficient to include the trading venues in the order execution policy. There are alternative trading venues, such as Cboe in Europe, which hold a significant part of the trading (in particular the blue-chip shares). Therefore, it is tempting to rely only on Cboe data for best execution documentation as an example. However, as the official closing price is the closing price of the incumbent exchange (which is most often based on closing auctions), it is not viable to only rely on Cboe data. A firm will need the proprietary data from the incumbent exchanges as well. Therefore, cost is a significant concern for market participants.

Please also note the increasing importance of (closing) auctions by in particular the incumbent exchanges which cements the exchanges dominant position.

As for suggested mechanisms to address to problems, please see our response to Q5 and Q6. This includes recommendations to ensure that fees and policies are clear, reasonable, and structured such that they are easily consumable by participants to avoid ambiguous applications of, for example, non-display usage. Display fees could be per "user" or per "source" at a single instance, while non-display fees should not require server counts or Multiple Instance Single Use. Exchanges could also utilize a cost-plus pricing model. Additionally, exchange data costs should also factor in the amount and quality of liquidity at that exchange.

As also mentioned in Q5 and Q6, it is important for regulators to supervise and enforce to ensure that fees are justifiably reasonable and consumable by market participants. To achieve this, it will be important for fees and costs to be disclosed by exchanges in a standardized manner for ease of comparison, with exchange justifications attached.

Q11. How should market data fees be assessed? How could this be implemented in practice? What factors should be considered and how can they be defined or applied?

Please also see our response to Q5 and Q6:

Generally, there are two usage types for data – display data usage (i.e., the data visible in trading systems and screens) and non-display data usage (e.g. for automated and program trading, as well as for functions such as portfolio valuations, investment analysis, order verification, risk management).

In our members' experience, fee structures are inconsistent amongst exchanges (e.g., per user vs per connection for display data) and are difficult to track – especially when it comes to "usage" and tracking entitlement. This is particularly the case for non-display usage, where some exchanges have required market participants to count their number of servers, machines and connections.

Some exchanges may charge display fees on a per data source basis (e.g., a user consuming data from the raw data feed, as well as that user's use of third-party vendors), which can cause participants to incur multiple separate fees per person. While some exchanges offer netting programs to address these issues, these are limited and with approvals complex to obtain.

Moreover, the introduction of multiple new ways to charge for data has led to increasingly complex contracts and opaque billing.

Members have also observed that the number of exchange audits have risen in recent years, which have indirectly increased members' data costs owing to expenses and work related to the cost of compliance to exchanges' data policies. For example, many audits require either the development of an internal entitlement tracking system, or the utilization of a third-party system. These issues have been accentuated in some cases where an exchange has outsourced the audit role and the focus of the audit work is then solely on revenue rather than the client's relationship with the exchange.

Members have also noted that on certain exchanges (in particular, exchanges with monopolies over various parts of the equity value chain such as matching engines and clearing) they are subject to unrelated infrastructure costs and legacy infrastructure related fees associated with market data, even if such infrastructure had become inactive and is replaced.

As liquidity profiles differ and may be fragmented for each stock across exchanges, data may not be interchangeable and thus used as a substitute for data from another exchange. Market participants require data from exchange in order to create a holistic view of the national market. While consolidated data is helpful, it lacks the granularity from each exchange required by participants to create the aforementioned view. As a result, many market participants are forced to purchase proprietary data feeds from individual exchanges in order to create a robust consolidated view of the market.

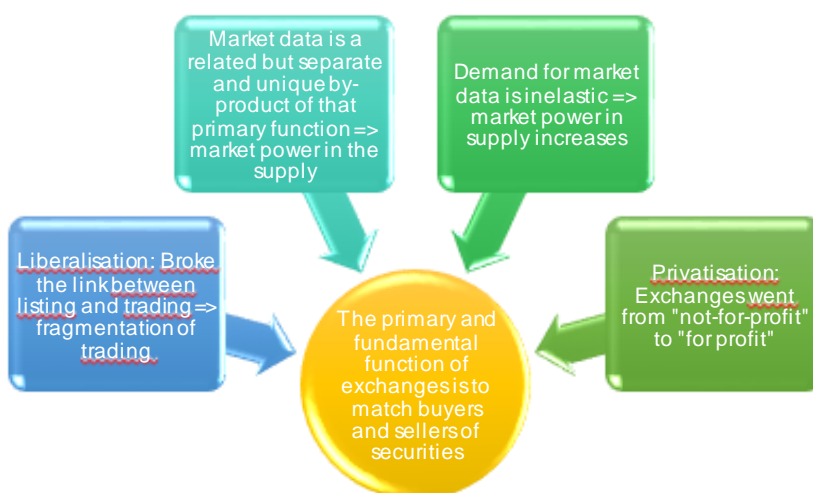
Given the economic burden to participants and the fact that demand for data is inelastic, it is important that fees and policies are clear, reasonable, and structured such that they are easily consumable by participants. For example, display fees could be per "user" or per "source" at a single instance, while non-display fees should not require server counts). Exchanges could also utilize a cost-plus pricing model. Additionally, exchange data costs should also factor in the amount and quality of liquidity at that exchange.

Participants should also not be required to pay infrastructure related fees for legacy infrastructure which is no longer active.

While exchanges formerly served as non-profit utilities serving to match buyers and sellers of securities, they have since become privatized for-profit organizations. Instead of continuing to derive most or all of their revenue from their listing or trading business, market data that was once given away freely or priced at minimal cost, has become a major revenue source for exchanges. It is therefore important for regulators to play a role in ensuring fees are justifiably reasonable and consumable by market participants. To achieve this, it will be important for fees to be disclosed by exchanges in a standardized manner for ease of comparison, and exchanges' justifications to be attached to such.

One crucial condition is that market data fees must **not** be based on demand as is the case to today but on the cost of production and distributing the market data as demand is inelastic and exchange have market power in the supply, cf. figure 6. Additionally, demand for market data is dictated by the regulations that cause participants to purchase market data.

Figure 6. The market power of exchanges in market data



As orders in financial instruments are supplied by the market participants via bids and asks and executed in the market, the market data (pre- and post-trade data) is automatically produced as a by-product. This implies that the marginal costs of producing market data are close to zero and the incremental cost of

production is related to collecting the information and distributing this to customers¹⁸. These limited costs are also clearly demonstrated in the IEX report.

Furthermore, to enable trading venues to comply with the regulatory requirements and facilitate consistent, uniform supervision and a level playing field among the covered entities a cost benchmark should be developed which may serve as the standard of reference for relevant regulators. If no standard of reference is available, it may become unnecessarily complicated for regulators to compare and monitor the costs and prices for market data. This is also elaborated in Q5:

The Core principles should entail

- 1 The price of market data and connectivity must be based on the efficient costs of producing and distributing the market data (as opposed to the value market participants derive from market data as the cost of input should not be based on the value of the output) with a reasonable mark-up. The cost should be measured against a recognised cost benchmark.**
 - a. Regulators should require trading venues to submit detailed cost and revenue data in order to understand the amount of mark-up exchanges impose.
 - b. As market data should be based on cost with a reasonable mark-up, exchanges should simplify contract terms and eliminate "non-display" categories. Instead, exchanges should consider simply differentiating between professional and non-professional users.

Please see IEX' cost study¹⁹ and Copenhagen Economics guideline to a cost benchmark²⁰ for inspiration in addressing principle one in more detail.

- 2. Trading venues of a single market system should standardize key market data contract definitions, terms and interpretations. Contract definitions, terms and policies should be specific and avoid overly broad or general terms.**
 - a. Market data licensing contracts should avoid "derived data" terms, which are lopsided and unfair, and instead should be governed by the general principle that licensing is provided on a fair and non-discriminatory basis. Standardized agreements should be subject to regulatory review.
- 3. Market data licensing contracts should be simplified to ease administration and so that audits are not necessary.**

Please see Appendix B and C for additional inspiration in respect of principle two and three in [Global Memo on Market Data](#).

Q12. Please provide details of other products or services related to market data that are provided by trading venues or other RDPs

Connectivity and port fees are an increasing revenue stream for trading venues in general and should be based on the same principles as the market data pricing, cf. our response to Q5.

¹⁸ <https://www.copenhageneconomics.com/dyn/resources/Publication/publicationPDF/6/466/1543587169/pricing-of-market-data.pdf>,
<https://www.copenhageneconomics.com/dyn/resources/Publication/publicationPDF/0/200/0/Regulating%20access%20to%20and%20pricing%20of%20equity%20market%20data%20-%20Revised%20version%2012%20September%202013.pdf>,
<https://iextrading.com/docs/The%20Cost%20of%20Exchange%20Services.pdf>

¹⁹ <https://iextrading.com/insights/cost-transparency-whitepaper/>

²⁰ <https://www.copenhageneconomics.com/publications/publication/a-guideline-to-a-cost-benchmark-of-market-data-how-to-obtain-reasonable-prices-of-market-data>

Q13. Please share your views on the fees for connected services that are necessary to access essential market data. If concerns are raised, please identify mechanisms to address them.

Please see our response to Q12.

Q14. Please provide your view on the need for consolidated data where there are securities trading on multiple trading venues. What should be the primary objectives of consolidated data and what outcomes should it lead to? How should these objectives and outcomes inform the nature of the consolidated data made available?

An appropriately constructed consolidated tape ("CT") could assist by providing a comprehensive and standardised view of the trading in the covered instruments. However, as noted above and in Q10, market data is not interchangeable and most participants (directly and indirectly) require a comprehensive and holistic view of liquidity and data across each of the exchanges in which they participate.

So, a CT is not a solution to the fundamental issues regarding the cost of market data. This issue must be addressed regardless of whether a CT exists as stated in our response to Q5 and Q6.

We would suggest IOSCO to not to be prescriptive in what it mandates for consolidated tape because each region is at a different stage of development and may have a different level of geographic fragmentation and also a different regulatory framework.

Q15. Is a consolidated data feed the most efficient mechanism to achieve these objectives and outcomes? If not, what are the alternatives that could help achieve these objectives and outcomes? How do these alternatives affect the cost of and access to market data? How can they be addressed?

Outside of the U.S., a Consolidated Data feed (CT) will never be a substitute for proprietary data, as firms cannot use a CT for trading purposes since the data is unique per venue. A CT will not solve the problem of high and increasing market data costs and it might also not be fit for solving best execution/fiduciary requirements. In the U.S., where there is already a CT, there are still problems with increasing market data costs. Some market participants under the current structure need to purchase the fastest and most comprehensive data provided by the exchanges.

And given that many participants require deep exchange specific data via direct feeds (or may only be interested in certain instruments or regions), we would suggest outside of the U.S. that a consolidated tape should be optional and participants should not be forced to consume the consolidated tape.

Please also see our response to Q11.

Q16. Please describe any issues or concerns not raised by IOSCO in this Consultation Paper and describe any suggested mechanisms to address them.

Under the conclusion page 13 in the consultation paper, there is a reference to ESMA's final report on market data, where it is stated that ESMA recommends a CT. Please be aware that ESMA explicitly states that a CT will not solve the market data problems (see point 2, page 10) and ESMA proposes a number of additional measures including legal changes to handle the market data problems (see e.g. page 26-27).

Please also note that transparency comes with a (significant) price tag, due to the high and increasing market data costs because of an unaddressed market failure. As described in Q9 there is an increasing trend towards downscaling purchase of market data access to an absolute minimum due to the costs of accessing and

using market data. This development hampers the possibility of new product offerings, innovation and/or access to new markets. Similarly, demand for and interest in less significant markets or products is reduced.

In conclusion, the unregulated dominant positions of trading venues and in particular the incumbent exchanges have several negative financial and real economic consequences – as shown in a growing body of related theoretical literature. The effects are expected to be large, as we are dealing with core financial infrastructure in modern economies, driving corporate decisions at the highest level. That said, there is at present no empirical literature giving any direct estimates of the potential cost of this lower level of market information and weaker price formation process.

The process is illustrated in figure 7:

Figure 7. The consequences of high market data costs

