# An analysis of market manipulation definitions around the world

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*This is a work in progress. Please do not quote*

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**Disclaimer:** The views presented here are solely the authors' and do not necessarily represent those of the WFE or its members.

# Contents

# Executive Summary

Preventing market manipulation is a paramount concern in financial markets. Ensuring market integrity by deterring and penalizing manipulation is crucial for upholding trust in markets and preventing price distortions that could impede efficient fund allocation, thereby safeguarding the benefits that markets bring to the broader economy.

As technology advances and regulatory landscapes evolve, detecting and thwarting such activities pose ever-shifting challenges. The emergence of novel phenomena such as the meme-stock craze of 2021 and the integration of artificial intelligence (AI) technologies in algorithmic trading have raised new questions and exemplify the dynamic nature of these challenges.

To support our commitment to fostering the integrity of financial markets, the World Federation of Exchanges (WFE) launched a research project to better understand how market manipulation is defined and penalised around the world, especially considering the challenges posed by new technologies and social media. For this purpose, in 2022 we conducted a survey among WFE members and affiliates to gather information about the various definitions, surveillance bodies, and regulatory frameworks employed to combat market manipulation across jurisdictions. We then applied textual analysis tools to identify commonalities and differences in definitions and penalties texts. To the best of our knowledge, this is the first time that global definitions of market manipulation are analysed from this perspective.

**Key findings:**

- The definitions of market manipulation vary greatly across jurisdictions, ranging from very concise (intentional) definitions to those that enumerate individual practices (extensive).
- Intent or scienter is explicitly mentione in most (85%) of the definitions of open market manipulation examined. Indications of how the market is harmed vary across definitions, with interference in supply and demand being the most commonly cited (35%).
- The semantic analysis of market manipulation definitions supports the notion that there is no uniform approach to defining market manipulation worldwide. Different jurisdictions emphasize different aspects of market manipulation in their definitions.
- The textual analysis of definitions shows that jurisdictions in the Asia-Pacific region tend to emphasise individual manipulative actions, while the ones in the EMEA region tend to revolve around the interference in supply and demand. In the Americas region, definitions show greater divergence in their approaches.
- The textual analysis of penalties show that administrative penalties (fines, reprimands, suspensions) are most frequently mentioned in the Americas region, while “criminal” or “imprisonment” are much less frequently mentioned compared with the EMEA and Asia-Pacific regions.
- In terms of readability, the results show that definitions of market manipulation tend to be overly convoluted, even when compared with other financial regulation texts. Among the regions, the definitions used in the EMEA region are the least readable. Penalty descriptions attract better readability scores.
- Market manipulation surveillance activities are often performed by the exchange and the authority (68% of cases in the survey). In a few cases, it is either the exchange (13%) or the authority (20%).
- The industry has been using AI technologies as part of its surveillance systems. Differences in definitions and penalties and lack of objective criteria to characterize illegal practices may pose a further challenge when training these models and for effective cross-border surveillance.

# 1. Introduction

Market manipulation, alongside insider trading (where individuals exploit confidential or privileged information for unfair advantage), stands as a form of market abuse that has drawn condemnation and prosecution throughout market history;[1] and for good reasons. Research has shown that not only does it give an unfair advantage to certain participants, but it also disrupts pricing mechanisms, thereby compromising market quality. In the U.S., for example, the results of Aggarwal & Wu (2003) underscore how market manipulation obstructs market efficiency. Similarly, Bhattacharya & Daouk (2022) highlight that markets lacking integrity may not operate as efficiently as those characterized by higher levels of integrity. Looking at Canadian equity markets, Brogaard, Li & Yang (2022) show causal evidence that *spoofing*[2] increases volatility and adverse selection, and decreases price efficiency, thus harming market quality.

Furthermore, market manipulation erodes trust and confidence in financial markets. When manipulation appears unrestrained, participants may feel disadvantaged and disinclined to engage in market activities. This erosion of trust impedes the normal functioning of markets, stifling liquidity, investment, and innovation. By distorting prices and undermining trust, market manipulation leads to an inefficient allocation of resources, ultimately jeopardizing the aggregate social welfare and impacting the broader economy. Thus, the prevention of market manipulation is of utmost importance

As markets progress and new technologies emerge, so too do strategies for market manipulation. Consequently, definitions, regulations, and surveillance mechanisms must continually evolve to address these changing dynamics. In a 2011 report, for instance, IOSCO identified at least four technological advancements that were anticipated to impact market integrity: the proliferation of algorithmic and high-frequency trading (HFT); market fragmentation and the rise of dark liquidity; direct electronic access; and co-location (IOSCO, 2011). In the European Union, the Markets Abuse Regulation (MAR), enforced from July 2016, expanded its scope to include benchmark manipulation, partly as a response to scandals like the LIBOR manipulation and other benchmark-related misconduct exposed in 2012 (Putniņš, 2020). Similarly, in the United States, the Dodd-Frank Act of 2010 introduced explicit provisions to criminalize *spoofing,* a tactic closely linked to algorithmic and high-frequency traders. However, one can also expect that, as new regulations are introduced, individuals with vested interests will seek to devise innovative methods to circumvent them.

Another challenge to detect and prevent market manipulation arises from the fact that the illegal activity may be occurring not in regulated exchanges, but it may involve unregulated or opaque markets. Over the counter (OTC) markets, for example, operate with limited transparency and may

[1] For a comprehensive history of market manipulation, see (Markham, 2014).

[2] Spoofing involves placing large orders with the intention of cancelling them before execution, creating a false impression of market demand or supply. A much publicized case was that of Navinder Sarao, a high-frequency trader who was sentenced for using spoofing techniques to manipulate the prices of E-mini S&P500 futures contract (Flash Crash trader avoids further jail time, *Financial Times*, January 28, 2020) .

provide ideal environments for the development of manipulative practices (IOSCO, 2013). Crypto-platforms are another case in point.[3]

Social media introduced a new dimension to manipulation strategies, facilitating the rapid dissemination of false information and coordinating behaviours. The 2021 GameStop events exemplify this, where several "meme" stocks saw artificially inflated prices, driven primarily by retail investors, notably those affiliated with the WallStreetBets forum on Reddit. This incident sparked concerns about the role of social media in information dissemination and in co-ordinating actions that could distort prices. It prompted questions about whether such events could be labelled as market manipulation, or whether a reconsideration of the definition of market manipulation is needed.[4]

Defining market manipulation has often been controversial. According to Putniņš (2020), this is partly because manipulation encompasses a very large and diverse set of practices. Additionally, to mitigate the risk of manipulators evading a too precise or narrow definition, legal definitions often lean towards vagueness. However, one of the main challenges stems from manipulation frequently being based on trades that are entirely legitimate, with the key distinction being solely the presence of malicious *intent* behind those trades.

How manipulation is defined also determines surveillance and rule enforcement strategies. Definitions that hinge on intent or scienter, for instance, may pose challenges to prosecution efforts due to the difficulty of proving intent. Consequently, some scholars emphasize the importance of focusing on the harm inflicted on the market, suggesting that effect-based definitions could offer a broader scope than intent-centred ones (Kyle & Viswanathan, 2008). In other cases, particularly in the commodity markets, a key element for the viability of illegal practices is the exercise of market power, as it can lead to price distortions unlikely to occur in a reasonably competitive market (Pirrong, 2008).

The challenges to identify and prosecute manipulative practices may further escalate with the use of some artificial intelligence (AI) technologies, which may be able to autonomously make decisions without being tied to the intentions of their programmers. In such cases, establishing causal links between actions and consequences may prove impossible due to the "black-box" nature of some of these algorithms.

Against this background, the present analysis examines different approaches to defining and penalizing market manipulation in global markets, aiming to address three related questions: Are there currently alternatives to intent-based definitions? how heterogeneous are the definitions adopted across different jurisdictions? and, what are the implications for effective surveillance?

As a starting point, we conducted a survey among members and affiliates of the World Federation of Exchanges (WFE) to collect information about the definition of market manipulation in their respective jurisdictions, the corresponding penalties, notable landmark cases influencing jurisprudence, and the

[3] See, for example, 54% of ERC-20 Tokens Listed on DEXes in 2023 Display Patterns That May Be Suggestive of Pump and Dump Schemes, but Represent just 1.3% of DEX Trading Volume, Chainalysis, February 1, 2024.
[4] See, for example: Michale Byrne, Social Media, GameStop, and the SEC: Did Reddit Traders Illegally Manipulate the Market?, Villanova Law Review, vol 66, May 11, 2021.

regulatory bodies tasked with monitoring and enforcing the regulatory framework. The survey garnered a robust response, with 40 exchanges actively participating. This represents a diverse spectrum of markets spanning all regions, including developed, emerging, and frontier markets. For a list of survey respondents, please refer to **Annex 1**.

To identify differences and commonalities among definitions across jurisdictions without imposing preset classifications, we use textual analysis tools to reveal intrinsic clusters in these definitions. Such tools allow us to identify common themes, terminology, and distinctive elements within these definitions. We analysed the readability scores of the market manipulation definitions to assess the complexity of the wording. The analysis also looks at the wording used in penalties associated with market manipulation. To the best of our knowledge, this is the first time that global definitions are analysed and compared using textual analysis tools.

The report is organised as follows. In Section 2, we review the related literature and discuss the definitions and models of market manipulation and the main empirical evidence supporting these models. Section 3 addresses the current challenges in defining market manipulation. Section 4 presents the survey results, including enforcement practices and penalties. In Section 5, we analyse the definitions and penalty descriptions using textual analysis. Section 6 covers market surveillance. Section 7 provides our conclusions.

# 2. Taxonomies of market manipulation

Before examining how market manipulation is defined across jurisdictions, it is useful to review the type of practices that these definitions are trying to capture. There are different ways of categorising market manipulation practices; the one proposed by Allen & Gale (1992), distinguishes three categories of market manipulation:

> **Action-based manipulation** is based on acts that could change the actual or perceived price of assets.
>
> **Information-based manipulation** relies on spreading false information or rumours that will change the perception of the value of a financial instrument.
>
> **Trade-base manipulation** (also called ***open market*** **manipulation**) occurs when a trader or traders attempt to manipulate the price of an asset simply by buying and selling the asset, without taking any observable actions to alter the value of the firm or releasing any false information to change the price.

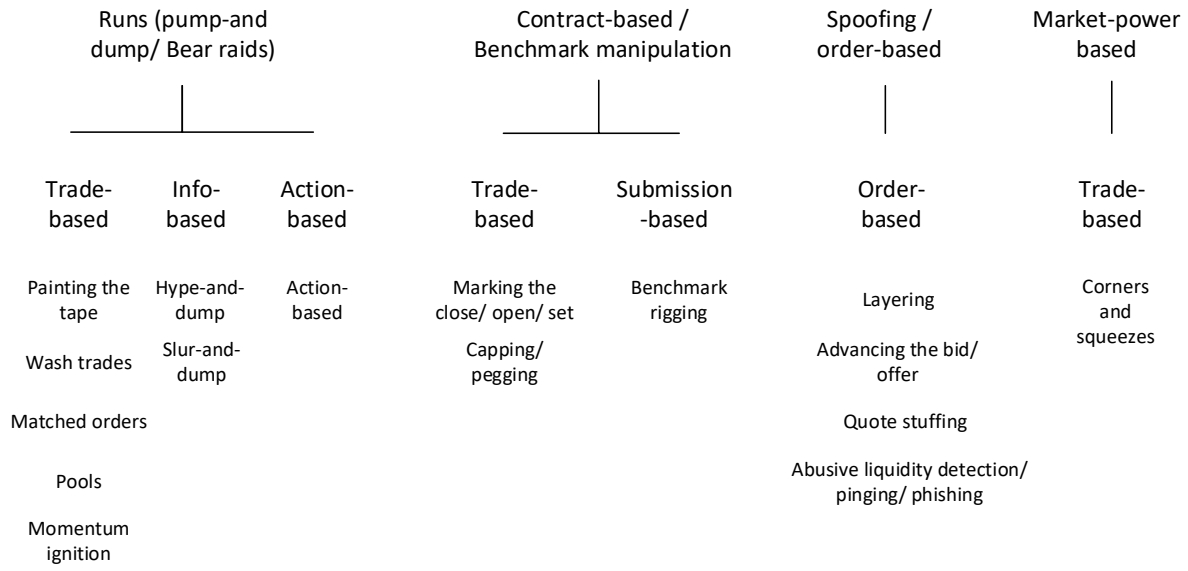
Within trade-based practices, **market power manipulation** holds a relevant position. It is mostly observed in commodity markets, in the form of *corners* and *squeezes*. According to Pirrong (2008),

(2017), this has been the most important form of manipulation in commodity markets and it could be considered a category on its own.[5]

Taking a different approach, Putniņš (2020) divides the manipulation strategies into four categories: "runs", "contract-based or benchmark manipulations", "spoofing", and "market power techniques", and then breaks down these categories according to the main mechanism used to facilitate the manipulation: "trade-based", "information-based", "action-based", "submission-based", and "order-based." (see **Figure 1)**. In particular, **order-based manipulation** involves strategies that aim to move the market by including orders that are not intended to be executed but only to provide misleading signals.

Under his taxonomy, Putniņš (2020) identified 17 different practices of market manipulation. In our survey, regulations across jurisdictions cited more than 30 different practices in aggregate, although some of them overlap (see **Appendix 2** for a glossary of practices).

*Figure 1: A taxonomy of market manipulation practices*




*Source: (Putniņš, 2020)*

[5] For instance, in a classic *corner* the holder of a big, long derivatives position on physically settled contracts demands a large number of deliveries against these contracts, forcing the counterparts to either incur large costs to make the inefficiently large deliveries, or pay a high price to the large long to buy back their contracts. Large traders can also exercise market power in physical markets by buying and selling excessive quantities of the commodity to distort the prices used to determine settlement value of cash-settled derivatives contracts (Pirrong, 2008).

## 2.1. Trade-based market manipulation

Among the different forms of market manipulation, trade-based manipulation has been particularly challenging to identify and sanction because, unlike other forms of manipulation, it relies solely on the impact of legitimate trades on market prices.[6] Since all trades influence prices, distinguishing between legitimate trading and manipulative actions seems to depend on establishing the *intention* behind a set of trades, a question which ultimately would mean knowing the state of mind of the trader. On the other hand, from an economic perspective, trade-based manipulation seems to be at odds with market efficiency assumptions, in what is sometimes called the *unravelling problem,* which we now briefly discuss.

### The unravelling problem

From a theoretical perspective, the plausibility of trade-based manipulation is often formulated in terms of the "unravelling problem" (Aggarwal & Wu, 2006) and (Milia, 2008): Can a trading strategy be profitable if it is based on buying shares (and therefore increasing their price) and then selling them (at a decreasing price)? A symmetric price pattern would mean buying high and selling low so, in an efficient market with rational participants, such strategy cannot be profitable. For the strategy to be profitable, there needs to be some asymmetry between the buying and selling phases.

For example, Jarrow (1992) shows that, for speculators with market power, the existence of manipulation trading strategies is related to the time asymmetry in the sensitivity of price changes to the speculator's trades: there could be a momentum in prices that reinforces price increases, so that when the stock is sold, prices are higher than the prices paid during the buying phase. The asymmetry could also be a consequence of asymmetric information: Allen & Gale (1992) show that, in a rational expectations framework where all agents maximize expected utility, it is possible for an uninformed manipulator to make a profit, provided investors attach a positive probability to the manipulator being an informed trader. Uninformed traders may suspect the price increase is due to some information they ignore (instead of a consequence of a strategy to mislead) and they will start to buy, creating a trend. The trend will push the prices up so, when the manipulator starts selling, prices are still high and the strategy will make a profit. The possibility of profitable strategies can also arise from the asymmetry between liquidity purchases and liquidity sales (liquidity sales are less informed, as they may be driven by exogenous factors) or if the probability of a buyer being informed is different from that of a seller being informed (Allen & Gorton, 1991). The existence of profitable strategies has also been supported by Vitale (2000) in the foreign currency market and by Aggarwal & Wu (2006), who show that a key to successful manipulation is to appear as an informed or credible party and therefore manipulators are likely to be "potentially informed" parties (e.g., corporate insiders, brokers, underwriters, large shareholders and market makers).

[6] Fletcher (2018) proposes a further distinction between **naked open market manipulation** (which we simply refer to here as open market manipulation) and **covered open market manipulation**, where a manipulator trades to trigger payments or rights in a separate contract or financial instrument, the pricing of which is affected by the trades.

Although real cases show these strategies can be profitable,[7] empirical evidence supporting theoretical models of trade-based market manipulation is limited (Milia, 2008).This is due to a decline in manipulation cases, as regulatory authorities have become more vigilant and sophisticated, and the lack of unbiased data, since available data is often biased towards successfully identified, investigated, and enforced cases.

The study conducted by Aggarwal & Wu (2006), for example, focuses on *pump and dump* schemes in the United States and analyses SEC enforcement actions from January 1990 to October 2001. Their evidence suggests that manipulators are "potentially informed" participants and can credibly pose as being informed about the future value of stocks. Studying the Pakistani market, Khwaja & Mian (2005) find compelling evidence of a specific trade-based *pump and dum*p price manipulation scheme. Their estimates suggest these manipulation rents can account for almost half of total broker earnings.

### Price positioning and market power

There are also trade-based strategies whose purpose is to fix a price at a certain level. They usually involve a position in a derivative and a position in the underlying. Kumar & Seppi (1992), for example, show that uninformed investors can earn positive profits by establishing a position in the future and then trading on the spot market to manipulate the spot price used to value the cash settlement price of the future at delivery. Similarly, Ni, Pearson, & Poteshman (2005) provide evidence of strike price clustering on option expiration dates and show that this is partially driven by proprietary traders manipulating the underlying stock price at expiration so that the options finish at-the-money or just out-of-the money, and consequently are not exercised.

In the commodities markets the most important form of manipulation has been a market power manipulation, in the form of *corners* or *squeezes* (Pirrong, 2017). These could be considered as action-based, as in (Pirrong, 2017), or as trade-based, as in (Putniņš, 2020).

## 2.2. Cross-market manipulation

The above cases of strategies involving derivative and spot markets are some examples of cross market manipulation. But cross-market manipulation strategies can be more complex; they can involve multiple-legged orders and a variety of counterparties and instruments, perhaps not within the same trading desk or not even within the same market, and with profits being taken elsewhere. A typical example could involve trading in two highly correlated assets, A and B, which are traded in different countries. A malicious trader can artificially manage to push the price of A while, in a different country and trading different instruments, a colluded trader benefits from selling B at higher prices. This could involve trade-based or order-based strategies.

[7] Aggarwal & Wu (2006) provide a real counterexample to the unravelling problem: on August 2, 2004, trading in Eurozone bonds on an interdealer platform, Citigroup placed orders to sell EUR 11 billion worth of 200 different bonds within two minutes, taking advantage of the forced slow adjustment of prices. It then repurchased 4 billion euros worth of bonds before many dealers stopped trading, making a profit of EUR 15 million.

Recently, there have been some high-profile cases of cross-market manipulation including, a spoofing scheme on U.S. Treasuries[8] and another on soybean futures.[9] According to Stenfords et al. (2023), cases of cross-market manipulation are increasing and they are difficult to detect without whistle-blowers. Furthermore, they point out that there is neither a specific theory on cross-market manipulation, nor a successful tool or methodology for detection. In their paper they develop a model to quantify the risk of cross-product manipulation and use the European government bond futures market to test it.

[8] NatWest pleads guilty to fraud in U.S. Treasury markets, U.S. Department of Justice press release, Tuesday, December 21, 2021.
[9] CFTC Charges Tennessee Trader and Two Entities with Engaging in Cross-Market and Single-Market Spoofing and Manipulative Schemes, CFTC Press Release, April 14, 2022.

## Box 1. Controversy around GameStop events

Early in 2021, internet retail investors following the subgroup WallStreetBets on the social network platform Reddit.com collaborated to increase the price of stock of targeted companies through a coordinated effort to purchase the stock, with the apparent goal to generate losses to hedge funds holding short positions. One significant case was that of Melvin Capital, a hedge fund that in November 2020 had filed a Form 13F disclosure with the SEC, revealing it had a short position on GameStop Corp. (GME), a video game retailer. WallStreetBets then initiated a short-squeeze on Melvin Capital's position by raising GME's price through a coordinated stock purchasing campaign.[10] By January 27 the GME price climbed to USD 347 per share, representing a more than 1,600% increase from its closing price on January 11 (SEC, 2021). Melvin Capital had to close out its short position after taking huge losses and having to reach out to obtain loans.[11]

Then, on the morning of Thursday 28 January, the Robinhood Financial, LLC trading platform restricted the purchase orders of GME and the price of GME plummeted. Robinhood cited SEC net capital obligations and clearinghouse deposits as two of the motivating factors. [12] The announcement triggered public outcry, with retail investors calling for the SEC to step in and address what they considered to be an illicit conduct on behalf of Robinhood.

***No intent to mislead, no case of illegal manipulation***

Whether these events constituted a case of illegal market manipulation generated some debate. Inciting a massive number of retail investors to purchase a specific security, in a coordinated effort, to influence its price seemed to be a case of market manipulation, as characterized in Section 9(a)(2) of the Securities Exchange Act of 1934. However, legal commentary has pointed out that these actions alone cannot amount to illegal market manipulation without also being accompanied by the requisite state of mind: "*WallStreetBets did not create artificial demand but instead an exorbitant amount of demand. Without illicit intent, no illegal market manipulation can occur*." [13] Retail investors were transparent about their intent to short squeeze the institutional investors and seemed to legitimately believe they identified an opportunity to profit from hedge funds' bets against GameStop.[14]

In 2021, a staff report by the SEC concluded that "*Whether driven by a desire to squeeze short sellers and thus to profit from the resultant rise in price, or by belief in the fundamentals of GameStop, it was the positive sentiment, not the buying-to-cover, that sustained the weeks-long price appreciation of GameStop stock*" (SEC, 2021).

[10] See, for example, What is the SEC going to do about GameStop? By Joshua F. Bautz, The New York State Bar Association (NYSBA). February 4, 2021.

[11] Melvin Capital, hedge fund targeted by Reddit board, closes out of GameStop short position, CNBC, January 27. Melvin Capital had to close in June 2022.

[12] An update on market volatility, Robinhood Newsroom, January 28, 2021.

[13] Game on: GameStop, market manipulation, and its implications, by Travis Strickler, Kentucky Law Journal Blog, September 22, 2021.

[14] Michale Byrne, Social Media, GameStop, and the SEC: Did Reddit Traders Illegally Manipulate the Market?, Villanova Law Review, vol 66, May 11, 2021.

# 3. The debate around market manipulation definition

Defining trade-based market manipulation is crucial because definitions form the foundation of the legal framework and are essential for effective surveillance and enforcement.

However, a satisfactory or generally accepted definition does not seem to exist (Fischel & Ross, 1991). One reason is that manipulation encompasses a very large and diverse set of practices (Putniņš, 2020), but it is also because, whereas some forms of market manipulation involve deception, fraud, and monopolistic prices, open-market manipulation involves no objectively bad acts and, instead, is accomplished through legitimate transactions (Fletcher, 2018).From an academic standpoint, Pirrong (2017) proposed a definition which he found in general agreement with a substantial portion of the scholarly and legal commentary:

> *"Price manipulation is intentional conduct that causes market prices to diverge from their competitive level (or, in the case of imperfectly competitive markets, exacerbates divergences between market prices and their competitive level)."*

Looking at the definitions that the courts and scholars in the U.S. have proposed, Fletcher (2018) observes that although different, definitions of market manipulation are structurally similar, framing the misconduct in terms of the trader's *scient* or *intent* and on the *harm* that is inflicted on the market, although they differ in what constitutes harm and how the harm ought to be measured or identified. A third element that we could add is *causation*. Probing causation, that is, showing that the accused's actions were the cause of the artificial prices, and probing intent, have often been the most controversial points.

## Proving intent and causation

The problem of definitions' reliance on intent has been the subject of intense academic and legal discussions. Determining the intent behind market participants' actions and establishing a causal link between their conduct and price divergences can be complex, especially in cases of open-market trading strategies.

In the U.S., for example, Fox, Glosten, & Rauterberg (2018) point out that, despite more than 80 years of federal law addressing stock market manipulation, federal courts continue to experience discord and uncertainty regarding the fundamental aspects of manipulation law. There is indeed ongoing debate and scepticism as to whether trading activity alone can be classified as illegal manipulation under U.S. Federal Law. In the absence of concrete evidence demonstrating the intent to manipulate, building a strong case for market manipulation has been challenging.

In the context of commodities, where situations such as unintentional corners or squeezes can arise due to natural factors such as abnormal weather conditions or exceptionally low crop yields, Johnson (1981) concluded there is no single act that can be universally deemed as manipulation per se; rather, a comprehensive examination of all relevant details is required to ascertain the presence of the ability and intent to manipulate the market.

On the other hand, based on his extensive analysis of manipulation cases in the commodity markets, Pirrong (2008) has argued that it is possible to avoid falling into the trap of trying to prove intention by looking at the economics behind the suspicious trades. The aim would be to show that the probability of a certain strategy being performed for genuine motivations is so small that one can conclude, with a high degree of certainty, the intent to manipulate. In this way, "economic and statistical analyses predicated on a firm understanding of the economics of manipulation can reliably detect manipulative conduct and manipulative intent and distinguish prices that are distorted by manipulation from those that are the result of the competitive forces of supply and demand" (Pirrong, 2008).

In short, definitions of market manipulation are incomplete, in the sense that, in many cases, one cannot decide whether a set of actions falls within the scope of the definition without additional information on the circumstances in which those actions took place.

Given these difficulties, some authors have concluded that, except for cases of fictitious transactions (e.g., wash sales, matched orders), which can be considered fraud (and therefore the concept of manipulation would be superfluous), manipulative trades are extremely difficult to identify and therefore market manipulation regulation should be dropped, since the costs of prosecuting market manipulation outweigh the potential benefits (Fischel & Ross, 1991).

### Harm to the market

Given the limitations of intent as the element to distinguish between illegal and legitimate practices, authors have highlighted the importance of focusing on the harm done to the markets. Referring to the CFTC and the SEC in the U.S., for example, Fletcher (2018) comments that the commissions' approach to enforcement actions, which are based on the assumption that the manipulative intent is sufficient to prove manipulation, is fundamentally flawed, and that intent is an insufficient tool for identifying open-market manipulations because it does not address what she considers the most important aspect of open-market manipulation: *how these transactions harm the market*. In her view, regulators should identify the conditions under which open-market transactions are harmful to the markets. Only those open-market transactions that impair the markets efficiency (by creating an artificial price) and undermine their integrity (by creating unfair and dishonest market conditions), should be considered illegal. In other words, conduct is harmful if it either (1) impedes the markets' efficiency, such as through interfering with price accuracy or negatively impacting liquidity, or (2) impairs the markets' integrity, such as through unfair practices that exploit the markets or other traders.

The harm done to the market is often described in terms of *interference* with the free play of supply and demand (or the proper interplay of markets forces), which *causes* an *artificial* (or *distorted*) price, but proving this can be controversial.[15] As pointed out by Fischel & Ross (1991), the main issue with testing for interference with supply and demand is that the concept of interference is essentially

[15] "Across a number of jurisdictions, arguably the two most important elements of market manipulation in case law, and often the most difficult to prove, are intent and artificiality" (Putniņš, 2020). Case-law in the U.S. implements a four-part test involving ability, intent, causation, and artificiality (Johnson, 1981).

equivalent to defining manipulation, leading to a circularity problem. On the other hand, for the concept of artificial price to be operational one must be able to differentiate between an artificial and a non-artificial price (the counterfactual). Defining and determining the competitive level against which price divergences are measured can be difficult, particularly in markets with imperfect competition. Assessing what constitutes a fair and competitive price, considering market dynamics, supply and demand factors, and information asymmetry, requires careful analysis and expertise.

In their discussion on how to define illegal market manipulation, Kyle & Viswanathan (2008) focus on the welfare effects of trading and propose that trading strategies should only be illegal if they undermine economic efficiency *both* by decreasing price accuracy *and* by reducing liquidity.[16]

Fox, Glosten, & Rauterberg (2018) also stress the importance of focusing on the harm to the market and suggest that for a trading strategy to be forbidden, four questions must be answered in the affirmative: (1) is the strategy, purely as a conceptual matter, distinguishable from other, clearly acceptable trading strategies, and does the strategy cause social harm? 2) does the strategy plausibly fit under the broad dictionary meaning of the term "manipulation"? 3) are there circumstances under which the strategy can yield positive expected profits, and do they occur frequently enough to cause concern? And 4) are there practical procedures for implementing a ban on the strategy whereby the social gains from its reduction or elimination exceed the social costs of doing so, including deterring socially valuable transactions that might be erroneously identified as examples of the practice?

## 3.1. AI and the question of intent and causation

In the same way that, decades ago, algorithmic trading and HFT were associated with novel ways of market manipulation, the introduction of AI in algorithmic trading has triggered speculation about potential new forms of market manipulation and the challenges they could bring. The fact that some AI algorithms are increasingly capable of acting autonomously and the “black-box” problem are two main concerns (see, for example, Azzuti, Ringe, & Stiel (2021) and Annunziata (2023))

First, as algorithms become increasingly autonomous, there is a possibility that they may engage in manipulative trading behaviours without human intervention. In addition to this, they can learn how to avoid detection by mirroring non-threatening trading, which would complicate surveillance efforts.[17] Given their learning abilities and their capacity to process large amounts of data, they could also devise new strategies that humans have not thought of. Another concern refers to the possibility of ‘tacit’ collusion among AI algorithms, where different algorithms could interact and coordinate to

[16] In their setting, they stress the importance of distinguishing between "Pricing accuracy" and "market efficiency." Pricing accuracy measures the precision with which prices provide signals to encourage efficient resource allocation. Market efficiency refers to the difficulty of making trading profits given available information. In a market that is about to be cornered, high prices are consistent with market efficiency because they accurately forecast the probability of the corner, but not consistent with pricing accuracy, because prices are providing signals to misallocate resources.

[17] See AI expert warn of algo-based market manipulation, Risk.net, 24 January 2024. (Wang & Wellman, 2020) propose an evolving game between the regulators, developing tools to detect manipulation, and a manipulator that obfuscates actions to evade detection.

perform illegal strategies (Azzuti, Ringe, & Stiel, 2021). Using a deep reinforcement learning algorithm to model how competing market makers learn to adjust their quotes, Cont & Xiong (2024) show that the interaction of market making algorithms via market prices, without any sharing of information, may give rise to tacit collusion.

According to Annunziata (2023), current rules governing market abuse in the EU are mostly insufficient to face the consequences of the above situations, largely because of the black box problem: both the developers and users of AI programmes with a high degree of autonomy may not fully understand and explain why and how their algorithms have generated a particular output. The human programmer may have no control at all over what the programme will eventually do. She may have designed an algorithm to trade with the sole objective of optimising profits using historical data, news, and social media information as inputs; but as the algorithm starts to trade and learns new profitable strategies, depending on its degree of autonomy, it may start to trade in ways that the programmer could not possibly have envisaged, and to follow strategies that the algorithm has generated without human intervention. This would undermine efforts to determine intent or causation in cases of presumed market manipulation. Intent and causation tests[18] usually rely "on the ability to find facts as to what is foreseeable, what is causally related, what is planned or expected, and even what a person is thinking or knows" (Bathaee, 2018). None of this seem to be applicable in the case of some AI algorithms.[19]

At the same time, Annunziata (2023) believes that the approach that MIFiD takes to manage risks in algorithmic trading and HFT is appropriate, "as it places the responsibility of ensuring the algorithms function properly on market participants." And while the current set-up may need reinforcement to address the challenges of increasingly autonomous AI, he sees no need to overhaul it.

Bathaee (2018) argues that the solution cannot be to regulate the level of transparency that AI must exhibit or to impose strict liability from harm inflicted by AI, since these solutions will be ineffective and will stifle innovation. Instead, he suggests modifying intent and causation tests with a sliding scale based on the level of transparency and human supervision. Other regulatory approaches are based on keeping a "human-in-the-loop" in all AI decisive processes, to guarantee personal responsibility and accountability (Azzuti, Ringe, & Stiel, 2021). Alternative views suggest testing AI trading strategies for

[18] Causation tests aim to demonstrate a causal link between the actions and the harm produced. They include the "but for test" ("but for the existence of X, would Y have occurred?"), the proximate cause (a defendant whose actions are closely enough related to the result is guilty) and the foreseeability test (could or should the person reasonably have foreseen the harms that resulted from their actions?).

[19] (Bathaee, 2018) discusses how AI will limit the applicability of different tests of intent: "Effect Intent tests, such as those that appear as part of market manipulation in securities and commodities law, assess whether a person intended a prohibited outcome, but because the operator of an AI device may not know ex ante what decisions or predictions the AI will make, it may be impossible to establish such intent. Basis Intent tests such as those that appear in constitutional, securities, and antitrust law, scrutinize the justifications or reasons for a person's conduct, but if a black-box AI's reasoning is opaque, then such tests will also be impossible to satisfy. Finally, Gatekeeping Intent tests, which limit the scope of a law or cause of action by requiring a showing of intent upfront, may entirely prevent certain claims or legal challenges from being raised in the first place when AI is involved".

their possible abusive tendency under different market conditions before deploying them in production; and embedding an algorithmic surveillance component within the structure of the algorithm (Annunziata, 2023).

## Box 1. Artificial intelligence (AI) and the black box problem

**Artificial intelligence (AI)** can be defined as a goal or aspiration (the goal of replicating human intelligence) that guides system design and is enabled by a set of technologies (Mittelsteadt, 2023). As such, it is as old as computer science itself. But it has been the recent progress in learning algorithms along with the availability of large data sets and of powerful specialized micro-chips that has fuelled the great progress in AI observed in the last two decades.

**Machine learning (ML)** is at the base of almost all AI technologies. Based on some input data, ML algorithms will produce an estimate about a pattern and, by optimizing an error function, they will 'learn', improving their predictive performance through iteration. Fundamental to ML is its learning capability and its capacity to make inferences; that is, to make predictions on data never seen before. Common ML algorithms include neural networks, decision trees, regression analysis, clustering, and random forests.

**Neural networks** are ML algorithms comprising a large number of interconnected nonlinear units (nodes) arranged in layers, mimicking brain cell connections. Each node connects to another, each building upon the previous layer to refine and optimize the prediction or categorization. A neural network that consists of more than three layers—inclusive of the input and the output layers—is considered a **deep learning (DL)** algorithm.

Classical (non-deep) ML is largely dependent on human intervention to learn. Human experts determine the set of features used to understand the differences between data inputs. Instead, DL algorithms are fed with raw data and are capable of themselves discovering which features are most important for classification, removing the need of human experts (LeCun, Bengio, & Hinton, 2015).

**Explainability and black box problem**

The explainability of AI refers to the technical, objective understanding of an algorithm's behaviour, such as the possibility of determining the importance of different variables in the model's output. More broadly, explainability can relate to the notion of an AI model being interpretable by and understandable to humans (ESMA, 2023).
A neural network adjusts itself for accuracy, transforming data at each layer. In a deep neural network, there are hundreds of millions of internal parameters adjusted. It becomes impossible for humans to understand, in this highly dimensional space, how patterns were identified or how decisions were made. This is why DL networks are typically regarded as scarcely explainable (they are black boxes).

# 4. Definitions across the globe

The approaches adopted by regulators and organisations to define, prevent, monitor, and punish market manipulation will naturally vary, given the different legal backgrounds.

Definitions of market manipulation are usually part of a country's securities legislation and can also be contained in the exchange's rulebook. The definition may be included in a single regulatory framework covering various markets (e.g., spot, derivatives, commodities, benchmarks), or it may be split across separate pieces of regulation, each specifying distinct guidelines and penalties for market manipulation based on the specific market or financial instruments involved. In either case, the intention is to ensure that market manipulation is effectively identified and prohibited across all relevant markets and instruments, regardless of their individual characteristics.

While market manipulation is usually distinguished from other illegal activities like insider trading or fraud, some regulations have overlapping or intertwined definitions. We start the analysis by distinguishing between *extensional* or *intentional* definitions.

## 4.1. Intentional vs extensional definitions

Definitions of market manipulation range from those describing the necessary conditions for a set of actions to be identified as market manipulation (*intentional* definitions) to those that attempt to capture the concept by providing a list of cases that should be considered market manipulation (*extensional* definitions). Explicitly listing the practices that should be considered (or not) as market manipulation can avoid some of the ambiguity of the intentional definitions. On the other hand, choosing an intentional definition, rather than a more detailed enumeration of cases, can make it more difficult for individuals to find loopholes that would facilitate evading the law. Also, by avoiding specificity, the responsibility of determining specific instances of manipulation is delegated to the courts, who will need to consider the individual circumstances of each case (Putniņš, 2020). Intentional definitions may also have a greater chance of remaining valid as markets evolve.

It is worth noting that, for the purposes of automated surveillance systems that monitor trading, intentional definitions will still need to be translated into a list of practices that can be encoded in a set of rules to be programmed.

Across the jurisdictions in the survey, definitions of market manipulation range between those that are concise to those that provide a detailed enumeration of prohibited practices.[20] The **Mexican Securities Market Law** provides an example of a concise (intentional) definition:

> *market manipulation shall be understood as any act by one or more individuals or legal entities, through which the free interaction between supply and demand is altered or*

[20] All regulatory texts used in this paper are in English. For non-English speaking countries, we consider the English translation offered by the local authority or the exchange.

*influenced, causing the artificial variation of the securities volume or price, in order to obtain a benefit in their own favour or to the benefit of third parties.*[21]

Other regulatory texts opt for an extensional definition, which are usually lengthier, depending on the level of detail. Some definitions combine both approaches; for example, an intentional definition may be offered in the preamble of the regulatory text followed by an enumeration of cases in the body of the text. Or the definition may consist of listing some general cases but keeping their description open-ended.

In the **U.S.**, for example, there is no agreed-upon definition of "market manipulation". Instead, the law broadly prohibits specific kinds of conduct as illegal manipulation. Nonetheless, the U.S. Supreme Court has said that "The term refers generally to practices(…) that are intended to mislead investors by artificially affecting market activity".[22] The Court has also stated that manipulation "connotes intentional or wilful conduct designed to deceive or defraud investors by controlling or artificially affecting the price of securities".[23] Accordingly, federal courts have held that practices are manipulative if they are "aimed at deceiving investors as to how other market participants have valued a security,"[24] or if they "creat[e] a false impression of supply and demand for [a] security" (see **Box 3**).[25]

To get a sense of the diversity of definitions, we just need to look at the number of words used. **Figure 2** shows the frequency with which definitions with a certain number of words occur across the jurisdictions included in the survey. The longer texts coincide with extensional definitions that include very detailed descriptions of individual practices. On the other hand, countries like **Panama** or **Colombia** rely on concise intentional definitions of no more than 200 words.[26] The most frequent situations correspond to definitions between 200 and 600 words.

[21] Article 370, second paragraph of the Securities Market Law. http://www.diputados.gob.mx/LeyesBiblio/pdf/LMV.pdf. The text also includes a description of exceptions. The translation is provided at the Mexican Central Bank (Banxico) website (link).
[22] Santa Fe Indus., Inc. v. Green, 430 U.S. 462, 476-77 (1977).
[23] Ernst & Ernst v. Hochfelder, 425 U.S. 185, 199 (1976).
[24] ATSI Communications, Inc. v. Shaar Fund, Ltd., 493 F.3d 87, 100 (2d Cir. 2007)
[25] GFL Advantage Fund, Ltd. v. Colkitt, 272 F.3d 189, 207 (3d Cir. 2001)
[26] In Panama, for example, in Article 252 of the Securities Market Law (Decree Law 1 of 1999 and its amendments), the characterization of "manipulation" involves less than 100 words:
*"Article 252. Manipulation. Any and all persons are forbidden from making offers for the purchase or sale of, as well as from purchasing or selling registered securities in breach of the agreements, which the Superintendence adopts in order to prevent the creation of a false or deceitful appearance that registered securities are being actively traded, to prevent the creation of a false or misleading appearance in respect to the market of registered securities, or to prevent the manipulation of the market price of any registered security for the purposes of facilitating the sale or purchase of such securities."* See:
https://supervalores.gob.pa/files/Ley/UNIFIED_TEXT_DL1-1999.pdf

## Box 2. Definitions in the EU

In the EU, market manipulation is defined in the EU Market Abuse Regulation (**MAR**), which came into effect from 3 July 2016, repealing the Market Abuse Directive of 2003. Some of the new elements introduced by MAR intended to adapt legislation to new technological developments, like algorithmic and High Frequency Trading (HFT).

MAR applies directly in each EU member state without requiring individual states to enact laws that implement MAR's provisions.

Art 1 of MAR establishes that the objective is to prevent market abuse to ensure the integrity of financial markets and to enhance investor protection and confidence in those markets.

Art 12(1) of MAR defines market manipulation by enumerating a set of four activities that are comprised by the definition. Broadly, these activities are (a) behaviours that give or are likely to give misleading signals, secure or likely to secure prices at artificial levels, (b) employing fictitious devices or any other form of deception or contrivance, (c) disseminating information through the media which gives or is likely to give false or misleading signals about supply and demand, and (d) transmitting false information relative to a benchmark.

In addition, Art 12(2) provides a non-exhaustive list of specific behaviours that should be considered as market manipulation: (a) securing a dominant position with the effect of fixing prices, (b) buying or selling at the open or close of the market which has or is likely to have the effect of misleading investors, (c) placing or cancelling orders which has the effects described in Art. 12(1) by disrupting the functioning of the trading system, making more difficult to identify genuine orders, creating false or misleading signals about supply and demand., and (d) disseminating information through the media, including the internet, or by any other means, which gives, or is likely to give, false or misleading signals as to the supply or demand.

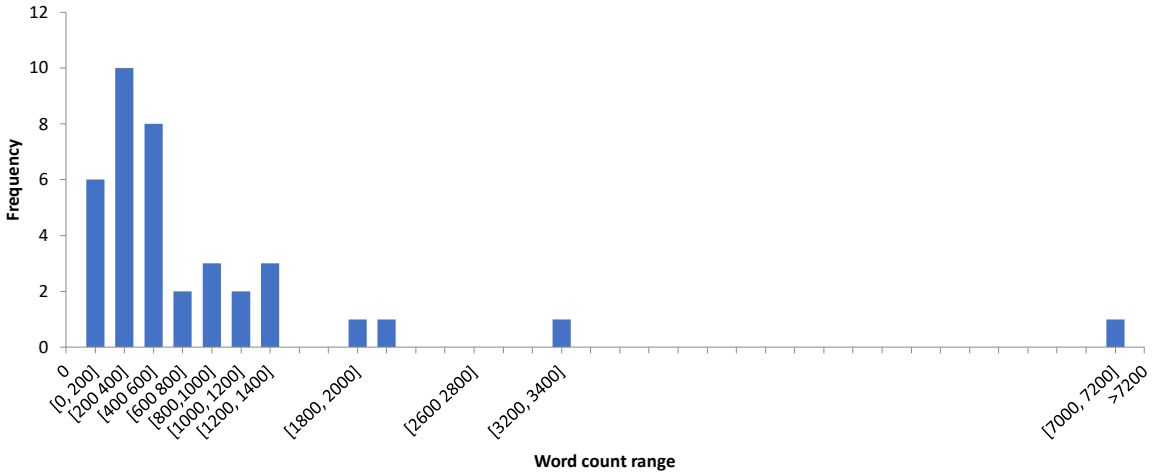
MAR not only considers when a practice caused harm, but also when it is "likely to" harm. This facilitates prosecution of cases in which the intent to manipulate can be established but the actual outcomes are difficult to measure, or the manipulator is unsuccessful in influencing the price. (Annunziata, 2023)

In 2011, the European Commission issued a proposal which aimed to introduce common criminal sanctions for insider dealing and market manipulation, ensuring a harmonised approach. This resulted in the Criminal Sanctions Market Abuse Directive **CSMAD** or **MAD II,** enacted in 2014.[27]

MAD II requires each EU member state to implement legislation to ensure that market abuse is a criminal offence which can be effectively punished.

[27] Directive 2014/57/EU of the European Parliament and of the Council of 16 April 2014 on criminal sanctions for market abuse (market abuse directive).
https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32014L0057

*Figure 2. Frequency of definitions using a given number of words*




*The horizontal axis shows the word count in the definition of market manipulation included in the relevant legislation. When there is an extensive and an intentional definition, both are considered. Similarly, if there are separate definitions for spot and derivatives markets, or when different pieces of legislation are relevant, they are aggregated. Descriptions of admisible trades are also included. EU countries in the sample are considered as one, since they share the same regulatory framework (if considered separately, they would add to the count in the range [1200, 1400]).To the extent possible, the analysis excludes other forms of market abuse (like insider trading) or fraud. It also excludes the description of penalties. A total of 38 regulatory frameworks is considered. Source: WFE Survey.*

Because open-market manipulation is based on legitimate trades, it is often necessary, as part of the definition of illegal practices, to also describe any specific circumstances in which the same trades that are listed as illegal should be considered acceptable. A typical case is, for example, when trading is aimed to artificially support a price in the context of a listing and therefore should not be penalised as a case of price fixing. For example, Article 370 of the Mexican law cited above adds the following:

> *It shall not be considered as a market manipulation, the execution of stabilization transactions consisting of the purchase of shares or negotiable instruments representing said shares, completed after the auction crossing in the stock exchange has been made by a public offering, concerning securities of the same class, series or kind and, provided no bids are made at a price higher than the placing price or at the price agreed in the last market transaction, whichever is lower.*[28]

Similarly, in the EU MAR, after defining in Article 12 the general cases that are considered manipulation, Article 13 defines some specific instances which should be considered acceptable practices.

[28] See footnote 9.

## Box 3. Definitions in the U.S.

Because of the historical separation between securities and commodity markets in the U.S., provisions against manipulation have evolved along different paths, although in recent years the regimes have converged (Fletcher, 2018).

Starting with the Grain Futures Act (GFA) of 1922, United States law has proscribed manipulation, specifically including corners and squeezes (Pirrong, 2017). In 1936 Congress expanded and strengthened the GFA and renamed it as **Commodity Exchange Act (CEA),** where Section 6 authorizes the Commodity Futures Trading Commission (CFTC) to sanction any person who has manipulated, or has attempted to manipulate, the market price of any commodity or futures contract.

One of the first pieces of regulation on stock market manipulation, not only in the U.S. but worldwide, is the Securities Act of 1934 (codified[29] at 15 U.S.C. § 78a et seq.), coinciding with the creation of the Securities Exchange Commission (SEC). Both were largely part of a response to the Great Depression and intended to eliminate stock market manipulation (Aggarwal & Wu, 2006).

The Dodd-Frank Act amended the CEA and adopted an explicit prohibition regarding *spoofing* in commodities markets.

Neither the CEA, the Securities Act of 1934 or the Dodd-Frank Act (2010) contain a definition of the term "market manipulation" although they include provisions dealing with specific instances of market manipulation. The onus of defining the term has fallen with the courts: the U.S. Supreme Court, for example, noted that the term referred generally to “practices, such as wash sales, matched orders, or rigged prices, that are intended to mislead investors by artificially affecting market activity” (Markham, 2014).

Provisions against market manipulation can be found across different texts: in the Securities Exchange Act of 1934, Section 9(a) (see 15 U.S.C. § 78i ); Section10(b), (see 15 U.S. Code § 78j), Rule 10b-5 (see 17 CFR § 240.10b-5), and Section 15(c) (17 CFR § 240.15c1-2).

Title 17 of the Code of Federal Regulation (CFR) we find Part 180 – Prohibition Against Manipulation For commodities, the CEA: 7 U.S. Code § 9 - Prohibition regarding manipulation and false information.

Other federal agencies have adopted anti-manipulation rules. The Federal Energy Regulatory Commission adopted its anti-manipulation rule (Rule 670, applicable in the natural gas and electricity markets FERC regulates) in 2006, and the Federal Trade Commission implemented a rule proscribing manipulation in petroleum markets in 2009 (Pirrong, 2017).

To successfully allege price manipulation, a plaintiff must show that: (1) the defendant possessed an ability to influence market prices; (2) an artificial price existed; (3) the defendant caused the artificial price; and (4) the defendant specifically intended to cause the artificial price (Fletcher, 2018). Specific intent requires that the defendant has “*acted (or failed to act) with the purpose or conscious object of causing or effecting a price or price trend in the market that did not reflect the legitimate forces of supply and demand.*” In re Ind. Farm Bureau Coop. Ass’n, Inc., No. 75-14, 1982 WL 30249, at *7 (C.F.T.C. Dec. 17, 1982).

## Intent and harm to the markets

In our survey, almost all definitions of open market manipulation rely, to different extent, on intent. In 85% of the cases examined, the definition explicitly talks about actions performed "with the intention" or " the purpose of" some form of deception (**Figure 3**). For example, in **Turkey**, Article 107 of the Capital Markets Law (CML) no.6362, refers to

> *Those who make purchases and sales, give orders, cancel orders, change orders or realise account activities with the purpose of creating a wrong or deceptive impression on the prices of capital market instruments, their price changes, their supplies and demands,*

However, there are other cases where the definition avoids explicitly mentioning intent and focuses on whether the information generated could be misleading or the prices created artificial. In the case of **Azerbaijan**, for example,

> *The following shall be considered manipulation in securities market: 78.4.1 entering into transaction or issue of orders (instructions), which provide false or misleading information about prices, demand and supply for securities or derivative financial instruments; 78.4.2 artificially maintaining and changing prices of securities or derivative financial instruments by a person(s), either alone or in collaboration with others, through entering into transaction or issuing order for entering into transactions;*[30]

In the **EU MAR**, market manipulation includes entering into a transaction, placing an order to trade or any other behaviour which:

> *(i) gives, or is likely to give, false or misleading signals as to the supply of, demand for, or price of, a financial instrument, a related spot commodity contract or an auctioned product based on emission allowances; (…)*
>
> *unless the person entering into a transaction, placing an order to trade or engaging in any other behaviour establishes that such transaction, order or behaviour have been carried out for legitimate reasons,*

But misleading is one kind of deception, and deception is defined as the communication of a message that is intended to cause a person to believe something untrue (Green, 2001). Therefore, it is unclear whether the question about the intent could be ultimately avoided.

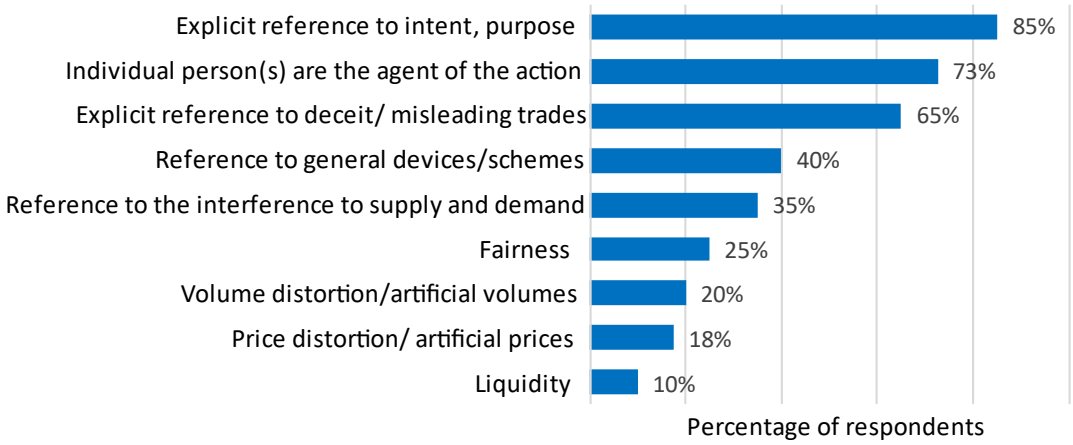
With regards to references to the harm done to the market, the most common one is the interference with supply and demand (35%) followed by unfairness (25%) and the creation of artificial prices (18%). References to market integrity or confidence in the markets are less common, one example being that of **Dubai**:

[29] The United States Code (U.S.C.) is a continuously updated compilation of most public laws currently in force, organized by subject matter.

[30] Law of the Republic of Azerbaijan on Securities Market

*Purchasing or selling or offering to purchase or sell Commodities, Options Contracts or Futures in a manner which may have the effect of destabilising the Market or resulting in a loss of confidence in the Market, so that prices will not properly reflect reasonable commercial values.*[31]

*Figure 3. Frequency of references used across definitions*




*The bars represent the percentage of regulatory frameworks in the survey which include in the definition of market manipulation explicit references to the given terms. Percentages are estimated on a total of 37 definitions. EU countries in the sample are considered as a single framework.*

EU MAR regulation, for example, mentions activities that secure a dominant position *that create or is likely to create an unfair trading condition* (Art 12, 2(a)), or that *disrupt or delay the functioning of the trading system*. In its preamble, the MAR also provides indicators which could be used to detect potential manipulative activities: for example, transactions that are concentrated within a short time span in the trading session and lead to a price change which is subsequently reversed, or trades that are removed before they are executed (MAR, Annex 1). It also highlights the need of examining if there were legitimate reasons, or accepted market practices that could motivate the observed price changes.

For administrative sanctions, MAR does not contain references to the intent or scienter, and the debate seems to be open as to whether such an element is indeed necessary (Annunziata, 2023). A decision by the European Free Trade Association (EFTA) Court in 2020, seems to support the conclusion that, for trade-based manipulation, although proving intention may be useful, it is not

[31] UAE Securities and Commodities Authority "SCA" Decision No. (157\r) of 2005 Concerning The Regulations as to Listing and Trading of Commodities and Commodities Contracts, Deceptive Trading, Article (6-11).

necessary, and that priority should be given to objective market conditions.[32] However, with regards to criminal sanctions, Art 5 of the EU MAD II expressly requires the subjective element of intent.[33]

Another interesting question, especially because of the AI-related issues that have been discussed, is to what extent responsibility falls on individuals as the trading agents, as opposed to, for example, those responsible of designing an algorithm. In the survey, in many cases (73%) the definition includes explicit references to a person or person(s) as the agent performing the illegal activity.

## 4.2. Enforcement and penalties

Together with the legal framework and the surveillance activities, ensuring that market manipulation does not go unpunished and that the penalties are significant are fundamental deterrents to manipulation practices.

The responsibility for enforcement actions is usually distributed between the exchanges, the self-regulatory organizations (SROs), the regulators, and the justice system.[34] In many cases, the exchanges not only monitor for manipulation, investigate potential misconduct, and report suspicious cases to the regulator, but may have authority to bar, suspend, and/or fine a person or entity if manipulation is proven. In other cases, the exchange has the responsibility to report to the regulator any conduct that may indicate illicit behaviour, but only the regulator has enforcement responsibilities. Finally, if the offense is severe, either the exchange or the regulator (or both) will report to the criminal authorities.

The IOSCO Principles for Securities Regulation establish that the regulator should have comprehensive inspection, investigation, and surveillance powers, it should have comprehensive enforcement powers and that the regulatory system should ensure an effective and credible use of inspection,

[32] "The assessment of false or misleading signals must be based on objective factors and consideration of the results of transactions and their effects. In examining whether a transaction conveys false or misleading signals, the real interest in buying and selling the security in question, while not by itself a necessary or sufficient element in finding market manipulation, may support a finding of such objective factors." Judgment in Case E-5/19 Criminal proceedings against F and G. See https://eftacourt.int/download/05-19-press-release-01-2020/?wpdmdl=6502

[33] *"Member States shall take the necessary measures to ensure that market manipulation as referred to in paragraph 2 constitutes a criminal offence at least in serious cases and when committed intentionally."* (MAR II, Art 5. par.1)

[34] Self-regulatory organisations (SROs) are private or semi-private organizations that have statutory regulatory authority and authority delegated on them from the government regulator. They include exchanges (that set and enforce trading rules); trade associations (setting enforceable codes of conduct) or full-service regulatory entities, such as the Financial Industry Regulatory Authority (FINRA) in the U.S. Exchanges can directly exercise this power, or, in some cases, they may create a separate entity, or can contract a third-party supplier of regulatory services (ICSA, 2006).

investigation, surveillance and enforcement powers and implementation of an effective compliance program.[35]

According to the responses to the WFE survey, the type of penalties imposed for market manipulation vary significantly, placing different weights on administrative sanctions (e.g., reprimands, fines, trading and license suspension); civil penalties (applied by a civil courts), or even criminal prosecution (including imprisonment), usually depending on the severity of the case.

In some cases, enforcement relies heavily on criminal sanctions. In **Indonesia**, for example, any person who violates the provisions around market manipulation "shall be subject to imprisonment for a maximum of ten years and a maximum fine of fifteen billion rupiah".[36]

In the case of **Turkey**, anyone found guilty of trading with the purpose of creating a wrong or deceptive impression on the prices of capital market instruments, their price changes, or their supply and demand,

> *shall be sentenced to imprisonment from two years up to five years and be punished with a judicial fine from five thousand days up to ten thousand days. However, the amount of the judicial fine to be imposed due to this crime cannot be less than the benefit obtained by committing the crime.*[37]

According to Carvajal & Elliot (2009) it is considered best practice for the regulator to have direct power to prosecute matters, whether in a civil or administrative venue, to avoid that only the most severe cases end up being prosecuted, which would leave plenty of room for low-level market abuse to go unpunished.

For instance, in **Colombia** the classification of market manipulation as an administrative or criminal offense is determined on a case-by-case basis, considering the specifics of each situation. Administrative cases fall within the remit of the Colombian Financial Superintendence (SFC) or the self-regulating authority (AMV) and penalized by those entities, according to their faculties. In **Singapore**, the Monetary Authority of Singapore (MAS) can pursue a wide range of enforcement sanctions, which include criminal sanctions (imprisonment or a fine); civil penalties (court action or settlement); prohibition orders; reprimands; and warnings, the severity of the sanction based on the nature and type of misconduct, the profile of the wrongdoer, and the specific facts and circumstances of each individual case.

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[35] Principles 8, 9 and 10 of the IOSCO Principles for Securities Regulation (IOSCO, 2003). As of 2007, less than 60% of 74 countries surveyed by IOSCO had fully implemented each of these principles, with the level of implementation correlated with the countries' income (Carvajal & Elliot, 2007).

[36] Article 104 of the Indonesian Capital Markets Act.

[37] Article 107 of Capital Markets Law (CML) no.6362. The penalty may be reduced if the person displays remorse or pays twice the benefit obtained. There are also administrative sanctions for "actions and transactions which cannot be explained with a reasonable economic or financial justification, which are of a nature deteriorating the functioning of exchanges and other organized markets in security, openness and stability (…) provided that they do not constitute a crime" Art. 104.

In the **EU**, Article 30 of the MAR provides for competent authorities to have the power to take administrative sanctions, without prejudice of any criminal sanctions they may consider, as well as to consider higher levels of sanctions than those included in the MAR. Additionally, Art 5 of MAD II establishes that the EU member states shall take the necessary measures to ensure that market manipulation constitutes a criminal offence at least in serious cases and when committed intentionally.

In the **U.S.**, the Securities and Exchange Commission (SEC), the primary government agency responsible for pursuing enforcement action against market abuse within securities markets, has broad powers which include initiating court proceedings for the imposition of civil penalties. If there is criminal misconduct, the Department of Justice (DOJ) has authority to prosecute (Austin, 2015).

In some countries, like **Panama**, enforcement does not include criminal prosecution, but the regulator can apply administrative sanctions (in addition to any disciplinary actions applied by the exchange).[38]

Enforcement is often difficult. It sometimes takes long time, like in the LIBOR case; it is usually costly, and its effectiveness depends on many factors. [39] Carvajal & Elliot (2009) found a correlation between the income level of a country and the robustness of its legal framework for enforcement.

[38] Article 272 of the Securities Market Law.

[39] The Libor and Euribor rigging scandals are a recent example. More than 10 years after they came to light, appeals are still ongoing and some cases have been dropped: Convicted ex-Barclays Euribor trader gets fresh shot at appeal, Financial Times, October 12, 2023. In the UK, the Libor investigation cost taxpayers at least £60 million (The Libor investigation may be over but we haven't heard the last of it, (SkyNews, 18 October 2019).

# 5. Textual analysis of definitions

It would be natural to assume that the differences or similarities observed when comparing definitions across jurisdictions can be explained by tracing the corresponding legal traditions and, in some instances, like Australia, this is indeed the case.[40] However, this assumption does not hold in general, partly because of the effects of consolidation of regional frameworks. In the case of the EU, for example, countries with different financial law traditions, like Spain (Franco-Latin), Ireland (English Common Law) and Germany (Germanic-Scandinavian) sit under the same regulatory umbrella.[41] As a consequence, countries that originally share the same legal tradition may have different approaches when it comes to a definition of market manipulation, and vice versa.

For the same reason, the maturity of the market does not seem to be a relevant variable either.

Therefore, to identify significant differences and commonalities among definitions without imposing any partitioning *a priori*, we will apply textual analysis tools to see whether (and how) the definitions cluster intrinsically. Such tools will help identify common themes, terminology, and distinctive elements in these definitions.

## 5.1. Semantic analysis of the definitions

The textual analysis of the definitions of market manipulation allows us to capture the key features and highlight the most important words and phrases used across different jurisdictions.

To perform the analysis, we employ the Part of Speech (POS) algorithm to classify words into noun, verb, adjective, or adverb categories. The words are then lemmatized[42] to their original form based on their corresponding tag classification. Stop words (e.g., "the," "a," etc.) and irrelevant words that do not contribute to the definition (e.g., "article") are removed. Additionally, errors resulting from the encoding format of the texts (e.g., "na" and "nan") are also eliminated. Using the remaining meaningful words and phrases, we calculate their frequency using the Term Frequency-Inverse Document Frequency Measure (TF-IDF). The TF-IDF measure helps us rank the words based on their importance in the definitions. The word cloud representation reflects this ranking, with more frequent words appearing in larger font sizes.

**Figure 4** presents a word cloud generated from this analysis, applied to the definitions of market manipulation across the whole survey sample. The words "security, " "person, " "transaction," "false, " " misleading," "market," and "trading" stand out as the most frequently used terms. This highlights the core of market manipulation definitions in the sample, which involves individuals engaging in deceptive and misleading trading activities. Furthermore, the definitions encompass various market

[40] Legislation on market manipulation in Australia can largely be traced to the U.S. regulation enacted by the Roosevelt administration (Goldwasser, 1999), the definitions we observe today are similar.
[41] We follow here the classification offered in (Wood, 1995).
[42] In textual analysis, lemmatization is the algorithmic process of determining the lemma of a word based on its meaning. For example, "doing" and "does" are transformed to "do", and "better" is transformed to "good".

segments and instruments, as indicated by the presence of words like "(spot) commodity," "stock," "future," "security derivative," "emission allowance," and "auctioned products." The word "purpose" also has relevance.

*Figure 4. Word cloud of market manipulation definitions (global)*

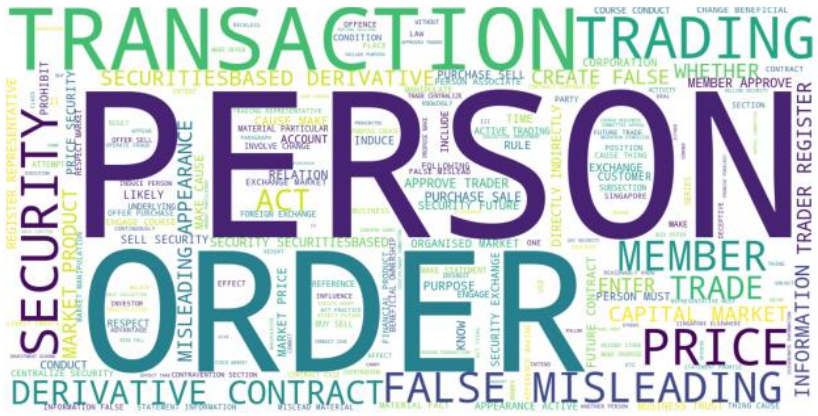

*The figure shows the word cloud based on the market manipulation definitions, according to the frequency of the terms used.*

The word cloud analysis conducted for different regions (**Figure 5**), namely the Americas, Asia-Pacific, and EMEA, reveals similarities compared to the global analysis. For example, in the three regions, the top five words include " security " and "person ". However, for the Americas, the top five words include "price," "market," and "security-based Swap"; while in the Asia-Pacific region, the top five words include "order," "transaction," and "trading", which suggests a bigger emphasis on trading orders and transactions. Lastly, in the EMEA region, "market," "transaction," "false, " and "misleading" are among the top five most common words. It is also worth noting that " purpose" is a frequent word in EMEA and America region's definitions but not in APAC.

*Figure 5. Word cloud of market manipulation definitions (by region)*

Panel A: Americas


Panel B: Asia-Pacific



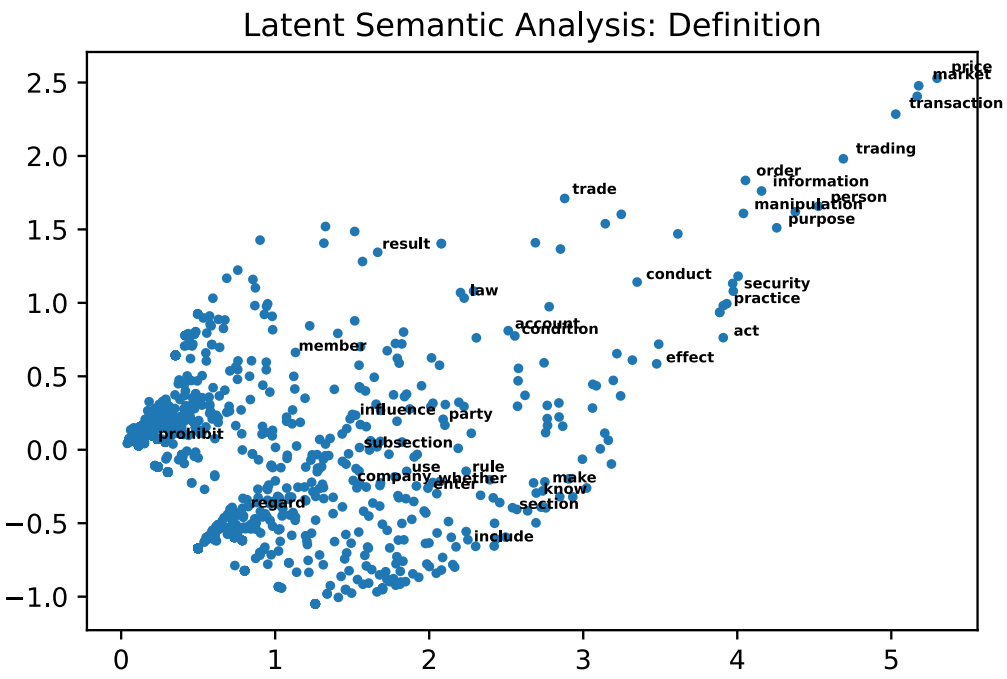

Panel C: EMEA


*The figure shows the word cloud based on the market manipulation definitions, according to the frequency of the terms used.*

In addition to word clouds, we also implement machine learning algorithms to determine main themes behind the market manipulation definitions. One method for this end is the Latent Semantic Analysis (LSA), which assumes that words with similar meanings or that support similar topics tend to appear in clusters within documents. By measuring the relationships of principal components, the algorithm identifies and groups closely related terms.

More specifically, in the LSA analysis, the definitions of market manipulation are first vectorized based on the words they contain, resulting in a matrix representation. The matrix is then subjected to the Single Value Decomposition (SVD) method to extract its principal components. These principal components represent the latent topics present in the definitions. Each word in the matrix is assigned a value for each principal component, indicating its correlation with that component. Words with higher values in a specific principal component are considered more influential in capturing that particular latent topic. To visualise the relationships between words and principal components, we create a two-dimensional plot using the first two principal components (**Figure 6**). This plot provides a graphical representation of how words are distributed in relation to the underlying latent topics identified through the analysis.

*Figure 6. Latent Semantic Analysis of market manipulation definitions*




*The figure shows the relationship among words used in the definitions based on the Latent Semantic Analysis. The location of the word is determined by its value in each of the first two principal components. The X-axis corresponds to the the first component (mean) and the Y-axis is the second component (variation relative to mean).*

The analysis of the principal components and their corresponding words provides some insights into the themes and variations within market manipulation definitions. The upper right corner of the figure represents a cluster of highly influential words that contribute to both latent topics identified in the

definitions. These words, such as "price," "market," and "transaction," play a crucial role in capturing the core concepts of market manipulation. Adjacent to this cluster, we find another group of significant words, including "trading," "order," "purpose, " and "information," among others. These terms are closely related to the primary topics and provide additional context and detail to the definition of market manipulation. In contrast, the remaining words scatter across the bottom left corner of the figure, indicating a diverse range of terms used in defining market manipulation across different jurisdictions. These results highlight the variability in word choice and emphasizes that market manipulation definitions can encompass a wide array of concepts beyond the commonly used terms. It also confirms " purpose" (or intent) as an influential word.

While the LSA can group words according to their relationship in the definitions without identifying the latent topics, Latent Dirichlet Allocation (LDA) is a technique that allows us to uncover the central topics across the collection of definitions and how the individual jurisdiction's definitions are distributed across the identified topics.

**Table 1** presents the output of the LDA analysis for market manipulation topics. Our LDA algorithm identified two key topics based on the words used in the market manipulation definitions.[43] For each topic, we list the key words that contribute significantly to that topic. These key words are sorted based on their importance, with the words at the top having higher weights in determining the topic.

Upon analysing the key words in each topic, we can identify certain nuances and distinctions between the two topics. The presence of the word "likely" in both topics suggests the challenge and potential ambiguity in identifying market manipulative actions but also reflects the importance of capturing manipulative practices regardless of whether the harm to the market materialized. Topic 1 focuses on general types of financial instruments, including terms like "financial instrument," "contract," and "product." It also highlights the interference with the "supply" and "demand". This topic suggests a broader perspective on market manipulation across various financial instruments. Topic 2, on the other hand, specifically highlights manipulative actions in the "derivative" and "future" markets. This topic zooms in on the manipulative practices that are specific to these particular market segments. Interestingly, the number of survey respondents is comparable between the two topics, with 21 respondents for Topic 1 and 19 respondents for Topic 2. This suggests that these topics are of similar popularity and relevance in the context of market manipulation definitions.

In addition, the distribution of market manipulation definitions across regions reveals some interesting patterns. Among the APAC jurisdictions, the majority of respondents (62.5%, 10 /16) have definitions that align with Topic 2, which emphasizes manipulative actions in derivative and future markets. In the case of the participating exchanges from The Americas region, their definitions are evenly distributed across Topic 1 and Topic 2, which suggests that these exchanges consider both the general types of financial instruments and manipulative actions in derivative and future markets as

[43] We finetune and validate the parameters in the LDA model by computing the coherent scores with different parameters based on a random sample that consists of 75% of the texts. Then we choose the LDA model with the highest coherent scores, and the optimal number of topics is identified in this process. Coherent scores measure the degree of semantic similarity among the most important words (e.g., whether the words support each other according to the topic).

significant in defining market manipulation. In the EMEA region, all the African respondents' definitions align with Topic 2, while all European responding exchanges and the majority (6/7) of the Middle East respondents indicated a definition following Topic 1.

*Table 1. Latent Dirichlet Allocation (LDA) of market manipulation definitions*

| Topic | Topic words | Total Count | Region | Count |
|---|---|---|---|---|
| 1 | member instrument financial contract commodity enter trader know supply spot | 21 | APAC | 6 |
| | | | Americas | 3 |
| | | | Africa | 0 |
| | | | Middle East | 6 |
| | | | Europe | 6 |
| 2 | exchange contract statement derivative likely section cause future appearance enter | 19 | APAC | 10 |
| | | | Americas | 3 |
| | | | Africa | 5 |
| | | | Middle East | 1 |
| | | | Europe | 0 |

*The table shows the two topics used in market manipulation definition texts, based on the Latent Dirichlet Allocation, grouped by regions.*

It is also informative to see that the highly important common words identified in the LSA (""price", " market ", " transaction") do not appear in the topic words in the LDA. The LSA algorithm identifies words that are common and important across all definitions. On the other hand, the LDA algorithm aims to identify distinct topics within the collection of definitions. It looks for words that are most characteristic and representative of each topic. Therefore, it is natural that the highly important common words identified in the LSA analysis do not appear as topic words in the LDA analysis.

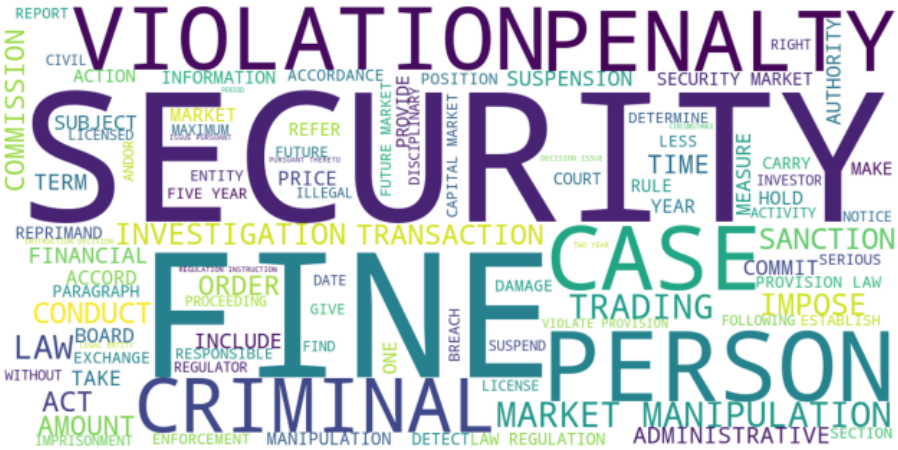
The findings from the semantic analysis of market manipulation definitions support the notion that there is no uniform approach to defining market manipulation worldwide, with different jurisdictions emphasizing different aspects of market manipulation in their definitions. However, amidst the diversity in definitions, the notion of deception or misleading behaviour is consistently recognised as a key characteristic of market manipulation across jurisdictions.

## 5.2. Semantic analysis of the penalties

In addition to the definitions of market manipulation, we also analyse the written rules on the penalties of market manipulation. We repeat the same textual semantic analyses (word cloud, LSA, and LDA) for the penalties texts gathered in the WFE survey.

**Figure 7**, displays the word cloud of the most frequently used terms in market manipulation penalties over the whole sample. The word cloud highlights terms such as "fine," "criminal," and "suspension," and "administrative," reflecting the range of punitive measures that jurisdictions employ to deter and punish market manipulation. The prominence of the term "fine" suggests that financial penalties are a common form of punishment for market manipulation. The relevance of " criminal" (and its prevalence over " administrative") confirms that in many cases (usually the most sever ones), market manipulation is treated as a criminal offense.

*Figure 7. Word cloud of market manipulation consequences (global)*




*The figure shows the word cloud based on the market manipulation consequences, according to the frequency of the terms used.The sample consist of the survey respondents.*

**Figure 8** displays the word clouds of market manipulation penalties by region and highlights the distinct emphasis placed on different penalties across jurisdictions. In the Americas region, the most frequent penalties include "fine," "suspension," " reprimand, " and "disciplinary" actions, which suggests a focus on civil or administrative sanctions, while " criminal" or " imprisonment" are much less mentioned (compared to the global case). In the EMEA and APAC regions, the key penalties revolve around "fine," "sanction," and "imprisonment," with " criminal" having a relevant position. As in the global case, this suggests an emphasis on the potential for criminal prosecution and imprisonment.

*Figure 8. Word cloud of market manipulation consequences (by region)*

Panel A: Americas

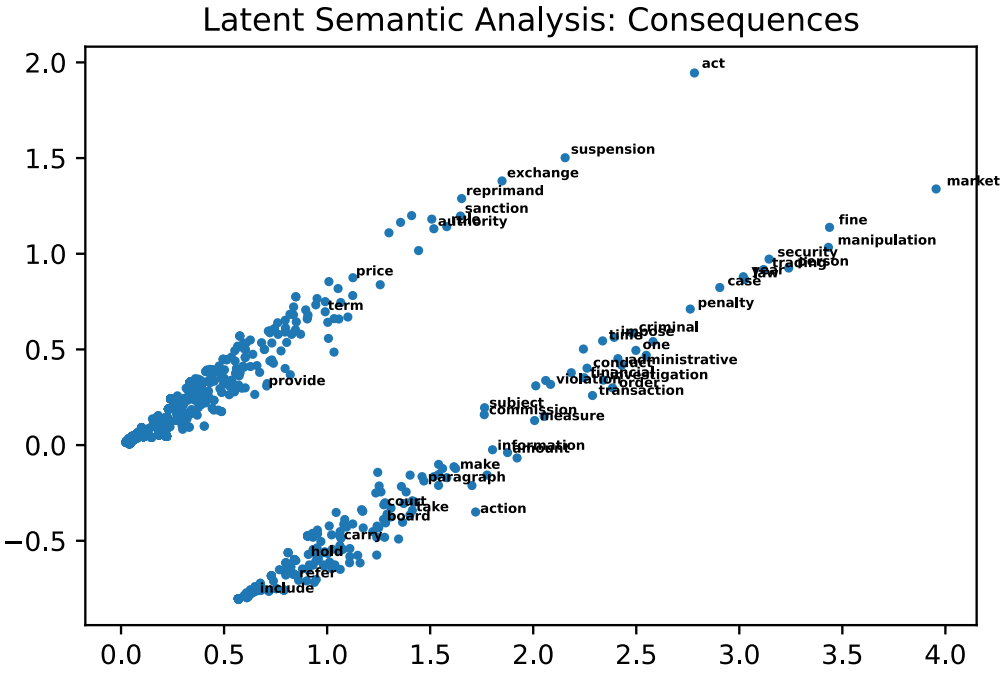

Panel B: Asia-Pacific


Panel C: EMEA


*The figure shows the word cloud based on the market manipulation consequences, according to the frequency of the terms used.*

**Figure 9** reveals two clearly distinct groups of words that emerge from the LSA analysis. The group on the right side of the figure includes words associated with the most severe consequences of market manipulation, like "law", "case", or "criminal". On the left side of the figure, we observe a cluster of words including the less severe penalties or consequences of market manipulation, including "sanction", " reprimand" and "suspension".

*Figure 9. Latent Semantic Analysis of market manipulation consequences*




*The figure shows the relationship among words used in the market manipulation consequences rules based on the Latent Semantic Analysis. The location of the word is determined by the first two principal components. The X-axis corresponds to the the first component (mean) and the Y-axis is the second component (variation relative to mean).*

**Table 2** presents the results of the LDA analysis conducted on the consequences of market manipulation. The analysis identifies three main topics, each characterized by specific keywords and themes. Topic 1, which is the most frequently observed topic across jurisdictions (24/39), centres around words like "security" and "person" or " criminal", which suggests an emphasis on the person engaged in the manipulative activities and include criminal sanctions as part of the potential penalties. This approach is particularly prominent in the APAC and Africa regions. Topic 2's key words include "entity" and "information" and also gives relevance to the person (" individuals ") responsible for the illegal practice. Topic 3 revolves around terms like "term," "year," and "sanction", which suggests paying particular attention to the duration or length of penalties imposed for market manipulation offenses. It is notable that a majority of the definitions that fall within this topic correspond to the Middle East region.

*Table 2. Latent Dirichlet Allocation (LDA) of market manipulation penalties*

| Topic | Topic words | Total count | Region | Count |
|---|---|---|---|---|
| 1 | security person shall law trading violation case exchange criminal regulation | 24 | APAC | 12 |
| | | | Americas | 1 |
| | | | Africa | 5 |
| | | | Middle East | 3 |
| | | | Europe | 3 |
| 2 | entity information penalty shall individual hold one use security | 6 | APAC | 2 |
| | | | Americas | 3 |
| | | | Africa | 0 |
| | | | Middle East | 0 |
| | | | Europe | 1 |
| 3 | term year act sanction security two engage member penalty rule | 9 | APAC | 1 |
| | | | Americas | 2 |
| | | | Africa | 1 |
| | | | Middle East | 4 |
| | | | Europe | 1 |

*The table shows the three topics used in market manipulation penalty texts, based on the Latent Dirichlet Allocation, grouped by regions.*

Overall, the textual analysis of the consequences of market manipulation indicates a segmentation by relations between words and by underlying topics.

## 5.3. Readability analysis of the definitions and penalties

To measure the accessibility and comprehensibility of these regulatory texts, we also analyse the readability of market manipulation definitions and penalty descriptions. The readability tests aim to assess the difficulty level of the texts and the reading comprehension required for individuals to understand their content.

More specifically, we carry out The Dale-Chall readability test (Dale & Chall, 1948), the Gunning Fog index (Gunning, 1952), and the Flesch-Kincaid grade (Kincaid, 1975), which are commonly used to estimate the readability of texts. These tests consider factors such as sentence length, word complexity, and grammatical structure to evaluate the readability of a given text. The Dale-Chall readability test assesses the difficulty of a text based on a list of familiar words that are commonly known to fourth-grade students in the United States. The test calculates a readability score by comparing the percentage of words in the text that are not on the list of familiar words. The Gunning Fog index measures the years of formal education required to understand a text. It considers the average sentence length and the percentage of complex words in the text. The Flesch-Kincaid grade

provides a readability score that corresponds to a U.S. grade level. It takes into account the average number of syllables per word and the average number of words per sentence. Detailed description of the readability tests can be found in **Annex 3**.

*Table 3. Readability tests*

**Panel A: Market manipulation definitions**

| Region | Dale-Chall | Gunning Fog | Flesch-Kincaid |
|---|---|---|---|
| Global | 11.88 | 33.10 | 32.37 |
| APAC | 11.29 | 26.20 | 26.51 |
| Africa | 13.77 | 54.24 | 52.65 |
| Americas | 10.67 | 20.64 | 19.67 |
| Europe | 14.08 | 55.40 | 53.88 |
| Middle East | 11.10 | 22.96 | 21.60 |

**Panel B: Market manipulation penalties**

| Region | Dale-Chall | Gunning Fog | Flesch-Kincaid |
|---|---|---|---|
| Global | 10.92 | 20.76 | 19.12 |
| APAC | 11.01 | 19.53 | 18.14 |
| Africa | 11.18 | 20.94 | 18.80 |
| Americas | 11.64 | 20.19 | 17.90 |
| Europe | 10.13 | 19.64 | 18.58 |
| Middle East | 10.53 | 24.99 | 23.44 |

**Panel C: Benchmarks**

| Text | Dale-Chall | Gunning Fog | Flesch-Kincaid |
|---|---|---|---|
| PFMIs | 10.48 | 14.12 | 13.90 |
| Encyclopaedia | 8.67 | 12.84 | 12.80 |
| Moby Dick | 5.96 | 10.27 | 8.80 |

*The table shows the regional average readability scores of market manipulation definition, penalty texts and benchmark texts based on the Dale-Chall readability test (Dale and Chall 1948), the Gunning Fog index (Gunning 1952), and the Flesch-Kincaid grade (Kincaid 1975).*

The results presented in **Table 3** indicate that, on average, market manipulation definitions tend to be challenging to read and comprehend. The Gunning Fog index and the Flesch-Kincaid grade level suggest that a significant level of educational training (often more than 30 years) is required to understand these definitions. When examining the regional variations, the Middle East and the Americas have the most readable market manipulation definitions, with an average readability score

equivalent to around 20 years of education (according to the Gunning Fog index). The Asia-Pacific region follows with an average score of approximately 26 years of education. In contrast, Africa and Europe have the most challenging definitions to read, with average scores corresponding to around 55 years of education.

The findings presented in Panel B reveal that market manipulation consequences are generally more readable compared to the market manipulation definitions. The global average Gunning Fog index and Flesch-Kincaid grade level indicate that, on average, the consequences can be understood by individuals with approximately 20 years of education. When examining the regional variations in readability, there are slight differences and inconsistencies among the results of the readability tests. The Dale-Chall test suggests that jurisdictions in Africa and the Americas have the hardest to read consequences, while the Gunning Fog index and the Flesch-Kincaid grade level indicate that Middle East has the most challenging texts. However, it is worth noting that the differences in readability scores among the regions for market manipulation consequences are not as pronounced as those observed for the definitions.

Panel C provides benchmarks for readability by comparing the market manipulation texts with (1) the Principles for Financial Market Infrastructures (PFMI)'s definition of financial market infrastructure,[44] (2) the Encyclopaedia Britannica's description of the financial market,[45] and (3) Herman Melville's 1851 novel Moby-Dick.[46] According to the readability test results, the definitions of financial market infrastructure in the PFMIs and the description of the financial market in the Encyclopaedia Britannica have a readability level that can be understood by individuals with approximately 14 years and 12 years of education, respectively. In addition, Herman Melville's novel Moby-Dick has a readability level that can be understood by individuals with around eight years of education. Compared with these benchmarks, market manipulation definitions and penalties are more challenging to comprehend.

# 6. Market surveillance

How market manipulation is defined and characterized is also important for market surveillance, which plays a crucial role in safeguarding the integrity of financial markets and in combating market abuse practices. Detecting market manipulation is essential for the authorities to take appropriate action and is a necessary condition for effective enforcement, which in turn is a strong deterrent for future wrongdoings.

Market surveillance is undertaken by exchanges, SROs, and regulators.[47] It usually involves the use of specialized software and automated systems designed to monitor and analyse market activities, aiming to identify unusual or suspicious trading patterns that may indicate potential cases of market

[44] The PFMI definition can be found here https://www.bis.org/cpmi/publ/d106.pdf, items 1.8 and 1.9.
[45] The Encyclopaedia's text can be found here https://www.britannica.com/topic/financial-market.
[46] From the Project Gutenberg, https://www.gutenberg.org.
[47] See footnote 19 for the definition of an SRO.

abuse. Detection of market manipulation can also derive from reports by financial intermediaries and voluntary reports by the public or by whistleblowers.[48]

Using surveillance software is the most common tool in market manipulation detection (Austin, 2015). These systems employ advanced algorithms and data analysis techniques to analyse large volumes of trading data to identify trading patterns that deviate from normal market behaviour. Usually, once suspicious patterns are identified, they are flagged for further investigation by specialised analysts, who will discard any false positives. Remaining cases are then referred to the enforcement authority for action. One example of software for surveillance that is used by many exchanges and regulators is **Nasdaq's SMART** platform.

As markets become more complex and interconnected, surveillance and enforcement face additional challenges. Therefore, market surveillance efforts often involve collaboration between local market regulators, exchanges, and brokers to monitor, detect and prosecute market manipulation, as well as cross-border collaboration. Such collaboration is even more important when OTC trades may be involved, given the opacity of those markets.

Surveillance efforts should also include different communication media, from chat-rooms to internet and social media. This creates additional challenges, given the speed at which information can be disseminated, the large volumes of data involved and the ability to hide or destroy evidence.

An additional challenge arises from the introduction of ML technologies which could facilitate more sophisticated and difficult to detect strategies. Before discussing these questions, we look at how the surveillance responsibilities are distributed across jurisdictions.

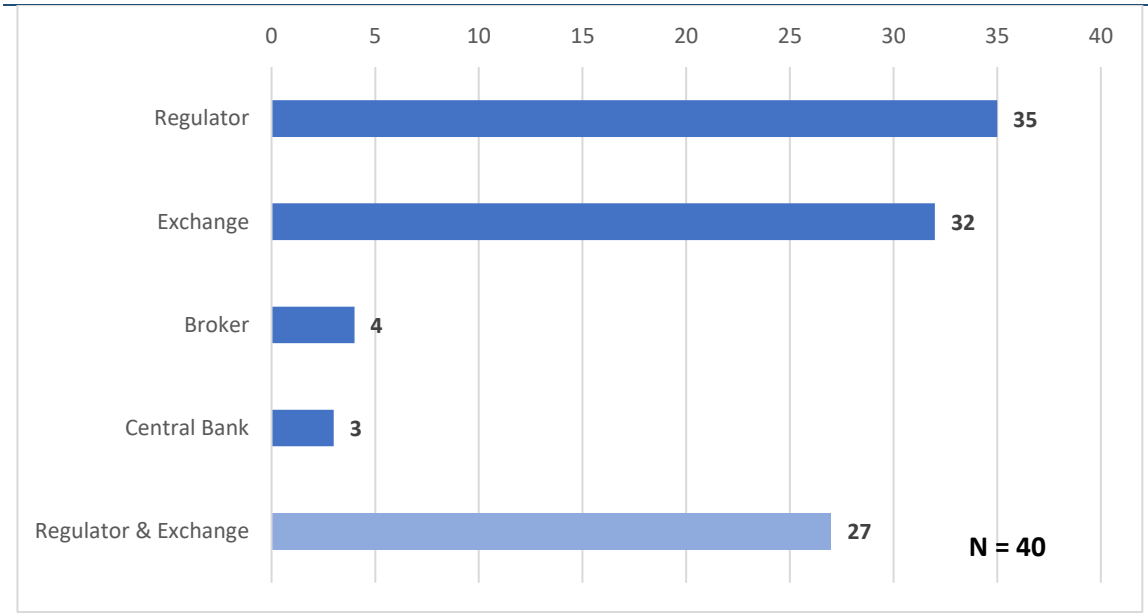
### Distribution of surveillance responsibilities

The distribution of surveillance and enforcement responsibilities vary across jurisdictions. In the survey we collected information on the entities responsible for detecting market manipulation in each jurisdiction (see **Figure 10**). We can see that, in most cases the responsibility for market surveillance falls with the local regulator (35/40) or with the exchange (32/40), but in most of those cases (27/40), the responsibility is shared among them. Only in a few cases is surveillance the sole responsibility of the regulator (8/40) or of the exchange (5/40). The collaboration between regulators and exchanges is common practice in many jurisdictions and helps to enhance the effectiveness of surveillance efforts. It is worth noting that, in a few cases, the central bank (3/40) is also reported to be responsible for market manipulation detection.

In some cases, the SROs are responsible for the surveillance and regulation of the market. In the **U.S.**, for example, the SROs include the Financial Industry Regulatory Authority (FINRA), which is responsible for the regulation of financial industry professionals, and the national securities exchanges, such as **Nasdaq** and the **New York Stock Exchange**.

[48] According to (Austin, 2015), there seems to be a tendency for this type of detection to be growing.

*Figure 10. Entities responsible for detecting market manipulation*




*The figure counts the responsible entities for detecting potential market manipulation actions based on the survey responses. Multiple answers were allowed.*

In **Japan**, surveillance for market manipulation in the cash and derivatives markets is done by the exchange, as an SRO, through the Japan Exchange Regulation (JPX-R) subsidiary, and the Securities and Exchange Surveillance Commission (SESC). The JPC-R analyses trading trends daily and receives information provided by parties inside and outside JPX Group. All trades that are suspected of being unfair are reported to the SESC. In **Switzerland**, the exchange as an SRO performs surveillance and, if irregular activity is suspected, the findings of investigations are forwarded to the regulator (FINMA). In Malaysia, the exchange (**Bursa Malaysia)** is also the front-line regulator, conducting real-time surveillance of all trading activities in the Malaysian capital market. In **Kenya**, both the **Nairobi Stock Exchange (NSE)** as a SRO and the Capital Markets Authority (regulator) undertake market surveillance functions, with the SRO as the front-line regulator.

In other cases, surveillance is done by the government regulator and the exchange, but the exchange has limited regulatory authority (it is not an SRO). In the UK, for example, both the **UK Financial Conduct Authority (FCA)** and the exchanges perform surveillance. The FCA can take administrative action and impose penalties or take disciplinary action against authorized persons and can also bring criminal prosecutions for market abuse (Austin, 2015). A similar arrangement is observed in **Hong Kong**.

In the **EU**, MAR requires persons arranging or executing transactions, market operators and investment firms that operate a trading venue to report orders and transactions that could constitute insider dealing, market manipulation (or attempted insider dealing or market manipulation) to the

## Box 4: Surveillance in Canada

Canada's securities regulation landscape is unique in that there is no single federal securities regulator. Instead, Canada's exchanges are regulated by provincial and territorial securities commissions. To streamline regulation efforts, securities regulators from each of the 10 provinces and 3 territories in Canada have teamed up to form the Canadian Securities Administrators (CSA). However, each province and territory continue to have their own securities law.

**TMX Group** exchanges are regulated by a combination of four provincial regulators: Ontario Securities Commission (OSC), British Columbia Securities Commission (BCSC), Alberta Securities Commission (ASC), and Quebec's Autorité des Marchés Financiers (AMF). While subject to the oversight of the AMF, the Montreal Exchange (MX) is also recognized as a self-regulatory organization. As a result, MX oversees market integrity on its trading platform. The self-regulatory function is carried on within MX's regulatory division (MXR).

The Investment Industry Regulatory Organization of Canada (IIROC) is recognized by the applicable securities commissions as a self-regulatory organization to monitor and regulate trading of equity securities on Canadian marketplaces that retain IIROC to be their regulation services provider.

Trading on TMX Group exchanges is monitored either by the IIROC or, in the case of the Montreal Exchange, by the exchange itself.

Surveillance is performed by the MX, who oversees market integrity on its trading platform, by the four provincial regulators, and by the IIROC (who oversees trading in exchanges and other marketplaces).

National Competent Authority of the trading venue. In 2021 and 2022, 52% of the cases reported corresponded to cases of alleged market manipulation (ESMA, 2023).

In Germany, while the **Federal Financial Supervisory Authority (BaFin)** is responsible for taking administrative actions against market manipulations, market surveillance is carried out by the German security exchanges themselves. The exchanges have their own surveillance systems to detect abusive behaviours and can act against manipulators who violate their rules, while also informing BaFin.

In **Sweden**, the Swedish FSA can detect manipulation through its own observations or through input from the market participants. **Nasdaq Nordic**, multilateral trading facilities, and their members (banks, brokers), are required to have qualified staff and systems to detect manipulation. Such surveillance can be outsourced or carried out in-house. Upon suspicion a report is to be sent to the Swedish FSA, which refers the report to the Swedish Economic Crime Authority, which can choose between writing off the referral/report without further actions; keeping the referral with themselves if deemed of severe impact; or routing back the referral to the FSA if deemed of less severity (but still of suspected manipulative character).

In Mauritius, the **Stock Exchange of Mauritius (SEM**) and Financial Services Commission (the regulator) are the main bodies responsible for detecting market manipulation.

Finally, in other cases, the regulator assumes both surveillance and enforcement responsibilities. In Australia, for example, the **Australian Securities Exchange (ASX)** previously conducted its own market manipulation detection. However, in August 2010, the **Australian Securities and Investments Commission (ASIC)** took over the responsibility of market surveillance, becoming the sole entity responsible for detecting market manipulations in the country. Similarly, in **Spain** it is the national authority, the CNMV, that is mainly responsible for market manipulation detection.

Analysing the effectiveness of different arrangements for market surveillance across 25 jurisdictions, Cumming & Johan (2008) found that first, jurisdictions with exchanges which are SROs carry out more intensive single-market surveillance than securities commissions; second, that cross-market surveillance is much more effective when different jurisdictions have information-sharing arrangements, and when such information sharing is broader in scope; and third, that cross-market surveillance is highly positively correlated with turnover velocity, with the number of listed companies and with market capitalization, consistent with the view that surveillance facilitates stock market activity.

With regards to the relation between surveillance efforts and the organisation of the exchange, recent empirical evidence on security issuance from 49 countries is consistent with the view that private enforcement benefits markets while public enforcement does little to benefit them (La Porta, Lopez-de-Silanes, & Shleifer, 2006). From a theoretical perspective, (Reiffen & Robe, 2010) found that that for-profit SROs have greater incentives to enforce trade practice rules than do mutual ones and that misreporting is more likely when an SRO is not-for profit.

### Cross border surveillance

As pointed out in (Austin, 2015), one of the main challenges for detecting manipulation is the difficulty of performing cross-border surveillance. While the same securities can be traded globally, surveillance tends to happen locally. Given the global nature of markets and differences in approaches across jurisdictions, without collaboration between regulators form different countries, there is a greater possibility that manipulative trades across global markets remain undetected.

Most securities regulators around the world are signatories to IOSCO's Multilateral Memorandum of Understanding (MMoU) which facilitates the exchange of information for enforcement purposes, including the prohibitions against insider trading and stock market manipulation. However, this does not include sharing daily information needed for surveillance purposes. On the industry side, the Investment Industry Regulatory Organization of Canada (IIROC), FINRA, and many large and small exchanges are members of the **Intermarket Surveillance Group (ISG)**, an organisation created in 1981 by US self-regulatory organisations, and which now has 63 members covering exchanges and SROs across the globe. The purpose of ISG is to "provide a global network for the sharing of information and the coordination of regulatory efforts among exchanges trading securities and other products to address potential intermarket manipulation and trading abuses".[49]

[49] See https://isgportal.org/

## 6.1. AI and market surveillance systems (MSS)

Artificial intelligence (AI) technologies have been garnering increasing attention in relation to the detection and prevention of market manipulation as they offer new possibilities for market surveillance and analysis. ML algorithms can process vast amounts of data, identify patterns, and detect anomalous trading behaviours that may indicate potential manipulation. They can continuously learn and adapt, improving their ability to detect new manipulative strategies. On the other hand, using these technologies for the purposes of market surveillance may become necessary as ML algorithms are also used for trading.

In this section we provide a summary of the current AI-based surveillance landscape and discuss some of the challenges associated with the definitions being used.

### How ML and AI are transforming market surveillance

In their traditional form, market surveillance systems (MSS) are systems programmed to detect specific market manipulation schemes based on predefined rules. The system would be monitoring the market, trying to detect suspicious actions based on certain patterns that have been observed in the past. The data input not only includes trading activity data, but can also include clearing data, news, and social media feeds.

The detection of suspicious behaviour is based on specific metrics. For example, symptoms of a *pump-and-dump* scheme would include prices abnormally moving up or down, and a large order arriving to take advantage of the move. Detection would imply monitoring for large volumes, unusual price movements, orders far from the best bid and offer or abnormal order book behaviour. There is the additional complexity that such strategies involve a sequence of trades, sometimes far apart in time, and the system needs to consider how the impact of individual actions propagates over time.

When actions are recognised as corresponding to suspicious behaviour, the system generates an alert, and the suspicious trades are investigated by (human) analysts. Traditional rule-based methods generate a high volume of false positive alerts (where legitimate trades are mistakenly flagged as manipulative); they are backward looking and are largely unable to identify new patterns. The use of ML technologies will allow to significantly overcome these shortcomings, reducing the number of false positives and adapting to identify and learn new patterns.[50]

The last decade has seen a significant amount of research showing the power of different AI techniques to detect market manipulation in markets. See, for example, (Öğüt , Doğanay , & Aktaş , 2009), (Tallboys, Zhu, & Rajasegarar, 2022), (Qili, Wei, Xinting, & Kunlin, 2019), or (Wang & Wellman, 2020).

[50] According to Martina Rejsjo, Head of Market Surveillance for Nasdaq's North America equities, in the U.S. equity market, for example, the old system issued around 1,000 alerts per day for human analysts to investigate, but only a fraction of these cases would subsequently be confirmed as fraud and result in heavy fines. *MIT Technology Review, November 2019* https://www.technologyreview.com/2019/11/07/65063/nasdaq-ai-will-now-watch-for-fraudsters-on-the-worlds-largest-stock-exchange/ .

## AI surveillance systems

Exchanges have shown great interest in leveraging AI technologies for market surveillance. In fact, many exchanges already utilise some type of AI to enhance their surveillance capabilities.

**Nasdaq** has been at the forefront of integrating AI into market surveillance. In 2019, it launched its Artificial Intelligence for Surveillance Patterns on its U.S. Stock Market (**SMART**) surveillance product.[51] Their system uses a combination of ML and deep learning algorithms to monitor trading activities. Its deep-learning component can process and analyse vast amounts of unstructured data, such as news and social media content (Corbet & Larkin, 2023).

In March 2018, **Japan Exchange Regulation** and **Tokyo Stock Exchange**, both part of **Japan Exchange Group (JPX**), decided to apply AI to market surveillance operations to detect such misconduct as market manipulation.[52] In 2018, **Hong Kong Stock Exchange** and the **Nigerian Stock Exchange** deployed the SMART tool.[53] In 2020, **SIX Exchange Regulation (SER)**, a company of **SIX Group**, launched the "Prometheus" trade monitoring application, an AI-based software.[54]

In recent years, **B3 - Brasil Bolsa Balcão** has been utilizing AI techniques to improve the operational capacity of its trading surveillance team. This includes: (i) using natural language processing to analyze a large volume of texts related to communications with market participants, to categorize their responses and determine if they justify the suspicious trading patterns; and (ii) applying AI models to time series data to identify unusual volatility.

In addition, B3 uses other AI techniques as a lab to identify unknown trading patterns, which can be used to create rules for the surveillance system. These techniques include clustering models to anomaly detection related to investors networks and fraud detection, as well as algorithms to predict trade volumes and detect artificial liquidity.

Other exchanges have already expressed a keen interest in exploring and potentially implementing AI solutions in the future. The considerations range from conducting pilot projects to embedding machine learning models in future releases of their surveillance systems. This shared interest reflects a recognition within the industry of the potential benefits AI can bring to market surveillance. As technological advancements continue, exchanges remain open to the evolving landscape of AI applications.

Regulators have also shown interest. In January 2022, **FINRA**'s migrated the majority of FINRA's market manipulation surveillance programme to using deep learning.[55] More recently, in September

[51]See https://www.nasdaq.com/press-release/nasdaq-launches-artificial-intelligence-for-surveillance-patterns-on-u.s.-stock Nasdaq's SMART surveillance system is used by over 170 banks & brokers and trusted by over 50 exchanges and 18 regulators.

[52] https://www.jpx.co.jp/english/corporate/news/news-releases/0060/20180319-01.html

[53] Hong Kong stock exchange enlists AI in fight against rule breakers, FT April 16, 2018 https://www.ft.com/content/64bcb136-412b-11e8-803a-295c97e6fd0b

[54] https://www.finews.ch/images/news/2020/09/mm_prometheus_en.pdf

[55] https://www.finra.org/media-center/finra-unscripted/deep-learning-market-surveillance

2023, the **SEC** told the U.S. Senate oversight committee that the AI technology is deployed "in some market surveillance and enforcement actions" and is used to identify market patterns.[56]

### The challenges

The use of AI in MSS presents similar concerns to those that have been raised in other areas, such as medical diagnosis, and which stem mainly from the black box problem. One of the primary challenges is aligning AI systems with existing regulatory frameworks to ensure that they comply with financial regulations while safeguarding market integrity and protecting investor interests.

Additionally, the ethical implications of using AI technologies in market surveillance and enforcement need consideration. The utilisation of some AI technologies in market surveillance isolates human decision-making from the process. Transparency, fairness, and accountability in algorithmic decision-making become crucial aspects to ensure the integrity of regulatory efforts. Similarly, the reliance on historical data and patterns for training ML models raises concerns about historical biases being amplified or perpetuated.

There are also some challenges which are specific to market manipulation surveillance, and which bring us back to the question of definitions.

First, the quality of data. AI models require large, high-quality datasets. Market anomalies tend to be rare and therefore the amount of labelled data that can be used to train the algorithms can be too small. One solution would be to pool data across markets, but the differences in definitions, rules and regulations around market manipulation can make this difficult (Zulkifley, Munir, Abd Sukor, & Mohd Shafiai, 2023).

Also, separating anomalous from normal instances requires defining a boundary, but these boundaries are often not precise (Tiwari, Ramampiaro, & Langseth, 2021), a situation that is further complicated by the lack of objective definitions.

In the context of EU MAR, Annunziata (2023), finds that the existing regulatory framework works quite well in respect of these new technologies, but sees room for two relevant improvements: a significant increase in the duties and powers of trading venue operators regarding the monitoring, detecting, and reporting of suspicious activity; and the introduction of a specific obligation for investment firms using algorithmic trading and high-frequency trading systems, to include appropriate measures in their software to ensure that the algorithms are adequately designed to monitor, predict, and anticipate situations that may result in market manipulation.

[56] SEC Says It's Using AI to Surveil Markets and Assist Investigations, Wall Street Journal, 12 December, 2023.

# 7. Conclusions

The present analysis aims to compare various approaches to defining market manipulation across global markets, identify commonalities and differences in definitions and penalties across jurisdictions, and examine how these definitions are adapting to new technological and market developments.

Regarding the differences across jurisdictions, we find significant variation in how market manipulation is defined. These definitions vary in length and in approach, ranging from intentional to extensional. The findings from the textual analysis of market manipulation definitions support the notion that there is no uniform approach to defining market manipulation worldwide. Different regions emphasise various aspects of market manipulation in their definitions. However, common elements across jurisdictions include notions of deception or misleading behaviour and the reliance on intent.

Similarly, the textual analysis of the consequences of market manipulation reveals segmentation based on underlying topics and the emphasis placed on different types of sanctions. Some jurisdictions prioritize administrative or civil sanctions, while others focus more on criminal penalties.

Additionally, the readability analysis of market manipulation texts highlights their complexity and difficulty in comprehension. The definitions of market manipulation, in particular, present significant challenges, requiring a high level of educational training to understand. Although the penalties are relatively easier to comprehend, they still exhibit complexity compared to other common financial texts.

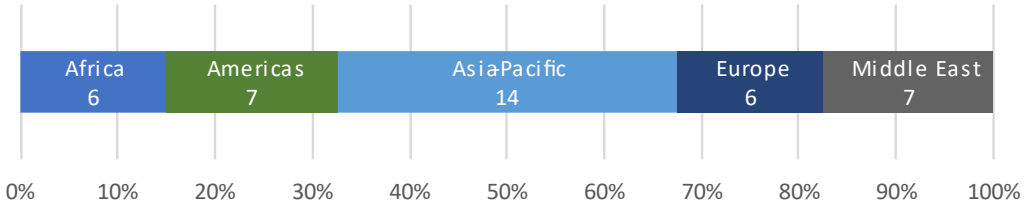
Finally, we discuss concerns arising from the use of AI in trading algorithms and surveillance systems. We explain why and how the definition of market manipulation can have important consequences in this context.

# 8. Annex 1. Survey participants

To gather data for this report, we designed and fielded a questionnaire to collect information on retail trading activity from exchanges across different jurisdictions. The questionnaire was distributed among WFE members and affiliates between October 2020 and June 2021.

We gathered **40 responses**, evenly split between High-Income (19 responses), Upper Middle-Income (15 responses) and Lower Middle-Income markets (6 responses).[57] All regions were represented, with 19 exchanges from EMEA, 14 exchanges from the Asia-Pacific, and seven from the Americas region (**Figure 11**).

*Figure 11. Respondents to the WFE survey. Distribution by regions*




## Exchanges that participated in the survey

Amman Stock Exchange
Asia Pacific Exchange (APEX)
Athens Stock Exchange (ATHEX)
Australian Securities Exchange (ASX)
B3 - Brasil Bolsa Balcão
Bahrain Bourse
Baku Stock Exchange
BME Spanish Exchanges
Bolsa de Valores de Colombia
Bolsa Latinoamericana de Valores (Latinex)
Bolsa Mexicana de Valores
Borsa Istanbul
Botswana Stock Exchange
Bursa Malaysia
Cboe Global Markets [US]
China Financial Futures Exchange (CFFEX)
Chittagong Stock Exchange
Dalian Commodities Exchange
Dubai Gold and Commodities Exchange
Ghana Stock Exchange
Indonesia Stock Exchange
Japan Exchange Group
Johannesburg Stock Exchange
Kazakhstan Stock Exchange
Luxembourg Stock Exchange
Mauritius Stock Exchange
MERJ Exchange Limited
Nairobi Securities Exchange
Nasdaq (Sweden)
Nasdaq (US)
Saint Petersburg International Mercantile Exchange
Saudi Exchange (Tadawul)
Shenzhen Stock Exchange
Singapore Exchange
SIX Swiss Exchange
Taipei Exchange
Taiwan Futures Exchange (TAIFEX)
Taiwan Stock Exchange
The Stock Exchange of Thailand
TMX Group

[57] This, according to the World Bank classification by income level 2021-2022. See https://blogs.worldbank.org/opendata/new-world-bank-country-classifications-income-level-2021-2022

# 9. Annex 2: A glossary of manipulation practices

**This table summarizes primary different types of market manipulation that are mentioned in market manipulation definitions and in the literature.**

***Action-based**** *manipulation involves taking real actions (e.g., operational changes within a company) to affect its price, rather than merely disseminating false information or trading.*

***Painting the tape****, involves engaging in a series of transactions that are reported on a public display facility (the " tape") to give a false impression of strong trading activity or interest in the stock. Painting the tape often involves "**wash trades** " and "**matched orders** ".

***Wash trades**** are spurious transactions in which the same person is the buyer and the seller (perhaps through different brokers); that is, there is no genuine change in ownership. The intention is to simulate trading activity or to display misleading prices.

***Matched orders**** involve pairs of buy and sell orders placed by different but colluding parties at the around same time for the same price and similar volume, usually seeking to have the same effect as when using wash trades.

***Pools**** occur when a group of manipulators trade shares among themselves to influence prices and create the appearance of trading volume.

***Momentum ignition**** involves executing a series of buys or sells in quick succession, often at progressively increasing/decreasing prices, with the objective of inducing others to trade. Once a trend is established, the manipulators reverse their position by selling to or buying from the trend followers. It can be implemented algorithmically and designed to prey on other trading algorithms that are programmed to respond to price movements.

***Hype-and-dump**** involves dissemination of positive, false information or rumours via the social media or similar, to inflate a security's price and then benefit from selling at a high price.
For example, in 2014, in Sweden, two medical students manipulated the price of 14 pharmaceutical stocks: they bought big positions, published very positive analyses, used fake aliases on social media to spread the word, lying about their profession and background. The analyses and forum posts were followed up with additional buying. In one instance the stock at hand increased by as much as 54% before starting to sell. The students made roughly USD 300,000 on their trading. Links (only in Swedish):
https://www.di.se/nyheter/sa-fifflade-studenterna-till-sig-miljoner/
https://www.di.se/nyheter/bloggande-studenter-doms-for-kursmanipulation/
https://www.svd.se/dom-mot-aktietipsande-studenter-fastställd

***Pump and dump**** involves taking a long position in a security and then undertaking further buying activity and/or disseminating misleading positive information about the security with a view to increasing the price of the security. Market participants are misled by the resulting effect on price and are attracted into purchasing the security. The manipulator then sells out at the inflated price. When misinformation is the strategy, it is also called **long and distort.**

*A notable example is the case of Jordan Belfort, whose memories, "The Wolf of Wall Street", were turned into a movie. Belfort and his associates engaged in a pump and dump scheme, artificially inflating the price of a stock by disseminating false or misleading information to attract investors. Once the price has risen, the fraudsters sell*

*their shares at the inflated price, causing the stock to plummet and leaving unsuspecting investors with significant losses*.

***Slur-and-dump**** is the inverse of hype-and-dump.

***Trash and cash (slur and slurp or short and distort)*** is the opposite of pump and dump. When there is collusion among short-sellers to drive the price down it is called a **Bear Raid.**

***Marking the close**** , also known as "**closing price manipulation**", "**high closing**", "**banging the close**", and "**punching the close**", involves buying or selling securities at or shortly before the close of trading to alter the closing price. Such price distortions are particularly harmful because of the widespread use of closing prices—for example to determine NAV or to price derivatives (see Comerton-Forde and Putnins, 2011, 2014). In October 2014, for example, the SEC sanctioned a New York City based high-frequency trading firm for placing a large number of aggressive, rapid-fire trades in the final two seconds of almost every trading day during a six-month period to manipulate the closing prices of thousands of NASDAQ-listed stocks. The firm, Athena Capital Research, used an algorithm code named "Gravy". The firm violated section 10(b) of the Securities and Exchange Act and marked the first HF trading manipulation case.

***Marking the open**** is similar to marking the close but influencing the opening rather than closing price.

***Marking the set**** or ***banging the set*** is also similar to closing price manipulation but involves trading to influence a particular reference rate at the time it is set, which is not necessarily the open or close of trading.

***Pegging**** and ***capping**** is a practice that involves activity on both the stock market and the derivatives market. It consists of trading the underlying to keep its price below (or above) the strike price of an option, so that the option becomes unprofitable to exercise.

***Benchmark rigging**** is a case of submission-based manipulation and involves making false or misleading submissions as inputs to a financial benchmark calculation. When the impact of an individual submission is small, submitters might collude to influence the benchmark.

***Layering**** is a form of spoofing that involves placing one or several orders on one side of a limit order book (the bid or the offer side) at one or several price steps to create a false or misleading impression of demand or supply. The manipulator's intention is for the orders not to execute and therefore most orders result in cancellations. The layering orders can be amended (or cancelled) as the market moves closer to the layering orders to avoid execution. Layering is often used repeatedly in a cycle together with other orders that profit from distorted prices. A typical layering cycle is as follows: (i) place a small sell order at or near the best ask price, (ii) layer the bid side of the order book until the market moves up and the small sell order executes, (iii) cancel the layering bid orders and repeat the above steps in the opposite direction.

***Advancing the bid/offer**** involves placing a buy or sell order within the prevailing best quotes for the purpose of setting a new best bid or best offer price. These orders are often not intended to execute and are therefore much like a layering strategy. Advancing the bid or offer can be used to give other market participants a false signal about the security's demand or supply. Advancing the bid or offer on a lit market can be used in manipulating the "midquote", which is often used as reference price by dark pools, crossing systems, and some alternative trading venues.

***Quote stuffing**** involves jamming a financial market's infrastructure, such as the matching engine that processes incoming order messages or the systems that disseminate market data to participants, by submitting an enormous number of order submissions, amendments, and cancellation messages in a short period of time

(typically, second or sub-second horizons). By overwhelming the financial market's processing capacity, quote stuffing can increase latency and impede timely information on the actual state of the orders in a market. It is sometimes considered as a form of spoofing.

***Abusive liquidity detection, * pinging***, or ***phishing*** involves submitting small probing orders for the purpose of detecting hidden or latent liquidity. While such orders can result in trade executions, their main purpose is to gather information about other market participants' trading intentions, which is then exploited to make a profit.

***Corner****** refers to the control or domination of the supply of a cash commodity. The market participant or group of participants then requires those holding short positions to settle their obligations under the terms of their contracts, either by making delivery or by purchasing the asset from the manipulator or by offsetting in the derivatives market opposite the manipulator at prices distorted by the manipulators.

In 2007, the CFTC charged BP with manipulation and attempted manipulation in the propane market. Specifically, for manipulating and attempting to manipulate the price of TET propane in February 2004, for cornering the market for TET propane in February 2004, and for attempting to manipulate the price of TET propane in April 2003. The CFTC commenced this civil action against BP on June 28, 2006. As a result, BP agreed to pay a total of $303M to settle those charges.

***Squeeze**** is a downward price manipulation occurring when short futures traders capture large supplies of the underlying cash commodity and engage in massive deliveries of those supplies in the futures market (Johnson, 1981).

**Abusive Squeeze**: This involves a party or parties with a significant influence over the supply of, or demand for, or delivery mechanisms for a security and/or the underlying product of a derivative contract exploiting a dominant position in order materially to distort the price at which others have to deliver, take delivery or defer delivery of the security/product in order to satisfy their obligations.

***Spoofing**** *(or* ***small lot bailing****)* consists of using a displayed limit order to manipulate prices, entering quotes followed by virtually simultaneous cancellations. The order is placed with the intention of briefly triggering a market movement from which the participant or others may benefit by trading the opposite side of the original order.

***Cybersmear*** *is a practice in which individuals post malicious messages about businesses in online fora, to manipulate the stock or to hurt a company they have a grievance against.*

***Scalping*** *is when a person buys shares of thinly-traded, small-cap companies, recommending the companies to the public, and then selling the majority of his shares when the increased demand generated by his favourable recommendations drove up the stock price.*

***Stock Basher****:* An individual, either acting alone or on behalf of someone else, who attempts to devalue a stock by spreading false or exaggerated claims against a public company. After the stock's price has dropped, the basher, or the basher's employer, will then purchase the stock at a lower price than that he or she believes it is intrinsically worth.

***Manipulative or abusive naked short sales***. Here, the short seller does not borrow or arrange to borrow the securities in time to make delivery to the buyer within the standard settlement period. The aim is to profit from a decline in the asset's price by later buying the shares at a lower cost to cover the short position.

***Interpositioning*** allows a brokerage firm to generate a profit from the spread between two opposite trades. It can take various forms. In one form, the broker purchases stock for the brokerage firm's proprietary account from the customer sell order; and then fills the customer buy order by selling from the brokerage firm's

proprietary account at a higher price — thus locking in a riskless profit for the brokerage firm's proprietary account. It can also involve the broker selling stock into the customer buy order, and then filling the customer sell order by buying for the brokerage firm's proprietary account at a lower price — again, locking in a riskless profit for the brokerage firm's proprietary account. In both cases, the broker participates on both sides of the trade, thereby capturing the spread between the purchase and sale prices, disadvantaging at least one of the parties to the transaction.

***Late Trading*** (or ***market timing***) involves purchasing mutual fund shares at the closing price after the market closes to exploit market inefficiencies when the "net asset value" of the mutual fund shares; which is set at the market close, does not reflect the current market value of the stocks held by the mutual fund.

***Holding the market*** refers to the practice of placing active or pending orders for a security into a market where the price is dropping rapidly in an attempt to "hold" the price of the security steady or create a floor in the security. This practice is unlawful except when a broker or other party is mandated to keep the price of a security steady as part of Price Stabilization or a buy-back programme.

***Ghosting*** is a practice whereby two or more market makers or brokers collectively attempt to influence and change the price of a stock.

***Free-riding*** is a practice in which an underwriting syndicate member withholds part of a new securities issue and later sells it at a higher price. This practice involves the activity of buying a stock and selling it before paying for the purchase.

***Bucketing*** refers to a brokerage that makes trades on a client's behalf and promises a certain price and/or confirms execution of an order to a client without actually executing it. The brokerage however, waits until a different price arises and then makes the trade, keeping the difference as profit in an attempt to make a short-term profit.

***Portfolio pumping*** consists of placing a large number of orders on existing fund's holdings to drive up the value of the securities within the portfolio right before the end of a quarter, when the fund's performance is measured.

***Excessive bid-ask spreads*** arise when intermediaries collude to move the bid-ask spread to and/or to maintain it at artificial levels and far from fair values, by abusing their market power.

***Short and extort*** occurs when short sellers state, for example posting messages on message boards, they would stop shorting the stock if they were given money or free shares.

***Overtrading*** is a practice employed by some brokers to increase their commissions by excessively trading in a client's account. It is also referred to as **"churn and burn**", **"twisting"** and "**churning"**.

***Uneconomic trading*** (Ledgerwood & Carpenter, 2012) consists in intentionally losing money on anomalous price-making trades to benefit the value of the trader's related price-taking positions, where losses are measured relative to the trader's opportunity costs.

# 10. Annex 3. Readability tests

**Dale-Chall readability test** (Dale & Chall, 1948)

$$\begin{cases} 0.1579\left(\frac{difficult\ words}{words}\times 100\right)+\ 0.0496\left(\frac{words}{sentences}\right), if\ \frac{difficult\ words}{words}\leq 5\% \\ \quad 0.1579\left(\frac{difficult\ words}{words}\times 100\right)+\ 0.0496\left(\frac{words}{sentences}\right)+\ 3.6365, otherwise \end{cases}$$

The higher the score the less readable the text is. An average undergraduate student could easily understand texts with score between 9.0 and 9.9.

**Gunning Fog index** (Gunning, 1952)

$$0.4\ [\left(\frac{words}{sentences}\right)+100\ (\frac{complex\ words}{words})]$$

The higher the score the less readable the text is. The score indicates the reading level by the U.S. education grade. For example, a Gunning Fog index of 16 corresponds to the reading level of an average undergraduate senior student.

**Flesch-Kincaid grade** (Kincaid, 1975)

$$0.39\left(\frac{words}{sentences}\right)+11.8\left(\frac{syllables}{words}\right)-15.59$$

The higher the score the less readable the text is. The score indicates the reading level by the U.S. education grade. For example, a Flesch-Kincaid grade of 16 corresponds to the reading level of an average undergraduate senior student.

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