# THE IMPACT OF THE USE OF ALGORITHMS ON ANTI-COMPETITIVE AGREEMENTS BETWEEN UNDERTAKINGS IN EUROPEAN UNION COMPETITION LAW

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## Abstract

*The rapid expansion of artificial intelligence and the widespread deployment of algorithms in the commercial strategies of undertakings have fundamentally reshaped the competitive landscape of the European Union's internal market. This article examines anti-competitive agreements between undertakings facilitated by algorithms from the perspective of EU competition law, with particular focus on the application of Article 101 of the Treaty on the Functioning of the European Union (TFEU) to novel forms of algorithmic coordination. The central argument is that anti-competitive agreements do not constitute an autonomous legal concept but a synthetic doctrinal construct, whose conceptual flexibility is sufficient to encompass algorithm-facilitated conduct without requiring express legislative reform. The article analyses the main functional typologies of algorithms, including pricing, monitoring and prediction functions and identifies three distinct modalities through which they may facilitate anti-competitive agreements: the reinforcement of explicit collusion, hub-and-spoke structures, and autonomous algorithmic tacit collusion. Drawing on landmark European Court of Justice jurisprudence – namely Dyestuffs, Hüls, Anic Partecipazioni, T-Mobile Netherlands and Eturas – the article demonstrates that the notions of agreement, concerted practice and exchange of information are sufficiently elastic to address algorithmic coordination, in particular through the technologically neutral criteria of competitive uncertainty elimination and the presumption of causal linkage between concertation and subsequent market conduct. The article concludes that EU competition law already possesses the necessary conceptual instruments to prevent and sanction algorithmic collusion, and that the primary challenge lies not in normative gaps but in the coherent and adaptive enforcement of existing rules.*

**Keywords:** *algorithmic collusion, concerted practices, pricing algorithms, hub-and-spoke structures, competitive uncertainty, exchanges of information.*

## 1. Introduction

At a time when artificial intelligence is in full development and is being used to an ever-greater extent, major changes are occurring both in interpersonal relations and in everyday human activities. At present, artificial intelligence is used in an increasing number of fields, if not all of them, generating substantial transformations in the practices adopted by natural persons and, at a structural level, by undertakings. The digitalization of the economy and the extensive use of algorithms in the activities of undertakings have led to various profound transformations, including in the manner in which competition manifests itself on markets. Undertakings have begun to make constant use of pricing algorithms, market-monitoring algorithms and algorithms for the automatic adaptation of commercial strategies, which are integrated into the day-to-day decisions of undertakings, with a view

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to increasing economic efficiency and optimizing interaction with consumers. In this context, a dissonance arises between the undeniable benefits of artificial intelligence systems and the risks they may generate for the functioning of effective competition, in particular through facilitating indirect coordination of market conduct among competitors.

Within this framework, the present article analyses anti-competitive agreements between undertakings facilitated by algorithms from the perspective of European Union competition law, with emphasis on the application and adaptation of Article 101 of the Treaty on the Functioning of the European Union[1] (TFEU) to novel arrangements arising from the use of algorithms. The starting point is the observation that anti-competitive agreements do not constitute an autonomous legal concept but rather a synthetic doctrinal construct reflecting the result of agreements, concerted practices and exchanges of information prohibited by Article 101 TFEU. This conceptual flexibility is essential for the analysis of algorithm-facilitated conduct, which does not always fit within the classical typologies of anti-competitive coordination.

The importance of the subject derives from the risk that the automation of economic decisions may lead to a reduction in competitive uncertainty and to an alignment of market conduct without direct, explicit or continuous contacts between undertakings – a situation that gravitates towards concerted practices. In such a context, the question arises whether the traditional instruments of competition law are sufficient to prevent and sanction these forms of coordination, or whether a rethinking of the criteria for attribution and proof of anti-competitive agreements is necessary.

The answer proposed by this article is based on an analysis of the case-law of the European Court of Justice, which, although it has not yet ruled directly on a case of autonomous algorithmic collusion, has developed principles of transversal and technologically neutral applicability. Cases such as Dyestuffs[2], Hüls[3], Anic Partecipazioni[4], T-Mobile Netherlands[5] and Eturas[6] demonstrate the capacity of competition law to adapt to innovative forms of coordination, through its emphasis on the elimination of competitive uncertainty, the presumption of causality and the irrelevance of the technical form of contact between undertakings.

By critically engaging with the specialist literature and by drawing on existing judicial reasoning, this article aims to demonstrate that Article 101 TFEU already possesses the conceptual resources necessary to address anti-competitive agreements facilitated by algorithms, without the need, at this stage, for express legislative reform.

[1] Published in the Official Journal C 326 of 26 October 2012.

[2] ECJ, 14 July 1972, C-48/69, *Imperial Chemical Industries Ltd. v. Commission of the European Communities*, ECLI:EU:C:1972:70.

[3] ECJ, 8 July 1999, C-199/92 P, *Hüls v. Commission of the European Communities*, ECLI:EU:C:1999:358.

[4] ECJ, 8 July 1999, C-49/92 P, *Commission of the European Communities v. Anic Partecipazioni SpA*, ECLI:EU:C:1999:356.

[5] ECJ, 4 June 2009, C-8/08, *T-Mobile Netherlands BV, KPN Mobile NV, Orange Nederland NV and Vodafone Libertel NV v. Raad van bestuur van de Nederlandse Mededingingsautoriteit*, ECLI:EU:C:2009:343.

[6] ECJ, 21 January 2016, C-74/14, *'Eturas' UAB and Others v. Lietuvos Respublikos konkurencijos taryba*, ECLI:EU:C:2016:42.

## 2. The Legal Framework Applicable to Anti-competitive Agreements between Undertakings in the European Union

Anti-competitive agreements between undertakings consist of forms of coordination of their market conduct which have as their object or effect the restriction, prevention or distortion of competition[7]. Thus, the conduct of at least two undertakings is coordinated towards certain actions which may consist, for example, in modifying the level of price or output. Such coordination may be achieved through agreements, decisions of associations of undertakings or concerted practices, forms of cooperation regulated and sanctioned at European Union level pursuant to Article 101 TFEU. Accordingly, anti-competitive agreements do not constitute a distinct autonomous legal concept but rather a synthetic doctrinal construct designed to cover the result of the conduct prohibited by Article 101 TFEU.

Pursuant to Article 101 TFEU, '(1) The following shall be prohibited as incompatible with the internal market: all agreements between undertakings, decisions by associations of undertakings and concerted practices which may affect trade between Member States and which have as their object or effect the prevention, restriction or distortion of competition within the internal market, and in particular those which: (a) directly or indirectly fix purchase or selling prices or any other trading conditions; (b) limit or control production, markets, technical development, or investment; (c) share markets or sources of supply; (d) apply dissimilar conditions to equivalent transactions with other trading parties, thereby placing them at a competitive disadvantage; (e) make the conclusion of contracts subject to acceptance by the other parties of supplementary obligations which, by their nature or according to commercial usage, have no connection with the subject of such contracts. (2) Any agreements or decisions prohibited pursuant to this Article shall be automatically void. (3) The provisions of paragraph 1 may, however, be declared inapplicable in the case of: any agreement or category of agreements between undertakings; any decision or category of decisions by associations of undertakings; any concerted practice or category of concerted practices, which contributes to improving the production or distribution of goods or to promoting technical or economic progress, while allowing consumers a fair share of the resulting benefit, and which does not: (a) impose on the undertakings concerned restrictions which are not indispensable to the attainment of these objectives; (b) afford such undertakings the possibility of eliminating competition in respect of a substantial part of the products in question'.

In analyzing Article 101 TFEU, it is necessary to define and clarify certain terms found in the EU regulation. First, there is the concept of the 'internal market', which presupposes a space without internal frontiers in which persons, goods, services and capital move freely under the same conditions as within Member States[8]. In this context of a free market, certain conduct of undertakings deemed incompatible is sanctioned.

Secondly, the main subjects whose conduct is analyzed are undertakings, which may affect trade between Member States. The concept of undertaking has undergone conceptual development through the

[7] Joseph E. Harrington, Jr., *The Theory of Collusion and Competition Policy*, The MIT Press, Cambridge, 2017, p. 1.

[8] Ioan Lazăr, Laura Lazăr, *Treatise on European Union Competition Law (Tratat de Dreptul Uniunii Europene în domeniul concurenței)*, C.H. Beck Publishing House, Bucharest, 2025, p. 24.

judgments of the European Court of Justice and is not legally defined at EU level. For example, in the Höfner[9] case it was held that, in competition law, 'the concept of an undertaking encompasses every entity engaged in an economic activity, regardless of the legal status of the entity and the way in which it is financed'[10]. By economic activity we understand the offering of both goods and services.

Another important term, through which the action of undertakings in the sense of Article 101 TFEU is materialized, is that of 'agreement'. This term is central, being the classical form of coordination adopted by undertakings in distorting competition. Agreements take the form of a consensus, of arrangements between undertakings or of conduct which is coordinated through the will of the undertakings. It is necessary to highlight the difference between agreements between undertakings and the unilateral conduct of a single undertaking – not only because agreements require two or more undertakings whilst in the second scenario the conduct belongs to a single undertaking without any direct influence from another, but also because the latter may fall within the scope of Article 102 TFEU if it meets the conditions of abuse of a dominant position.

Another term which is close to an agreement between undertakings but must be distinguished from it is the concerted practice, which presupposes a form of coordination or practical cooperation between undertakings, realized through direct or indirect contacts between them, of a nature liable to influence their conduct or strategy on the market[11]. Another definition of concerted practices consists of 'those deliberate behavioural alignments, produced through deceptive or simulative means, not formally reduced to a legal instrument, through which competitors in the relevant market supply each other with sensitive information (trade secrets or similar) with the intention of using it to coordinate the market policy of the participants'[12]. The definition thus formulated presents, however, a number of limitations, as it introduces conditions which do not follow from Article 101 TFEU and from the case-law of the European Court of Justice, such as the deliberate character of the conduct, the use of deceptive means or the existence of an intention to coordinate, and it unjustifiably narrows the scope of the concerted practice to a mere exchange of sensitive information, whereas in EU law the essential element is the existence of direct or indirect contacts capable of eliminating competitive uncertainty and influencing the market conduct of undertakings, even in the absence of a formal agreement.

In this regard, in the Dyestuffs[13] case, the European Court of Justice 'explained that a concerted practice is "a form of coordination between undertakings which, without having reached the stage where an agreement properly so-called has been concluded, knowingly substitutes practical cooperation between them for the risks of competition". Hence, a concerted practice is, firstly, a reciprocal cooperation, and secondly, it is such cooperation, which knowingly substitutes competition.

[9] ECJ, 23 April 1991, C-41/90, *Klaus Höfner and Fritz Elser v. Macroton GmbH*, EU:C:1991:161, para. 21.

[10] Augustin Fuerea, *European Union Law. Principles, Actions, Freedoms (Dreptul Uniunii Europene. Principii, acțiuni, libertăți)*, Universul Juridic Publishing House, Bucharest, 2016, p. 314.

[11] Ioan Lazăr, Laura Lazăr, *Treatise on European Union Competition Law (Tratat de Dreptul Uniunii Europene în domeniul concurenței)*, p. 223.

[12] Adriana Almășan, *Competition Law (Dreptul concurenței)*, 2nd ed., revised and enlarged, Hamangiu Publishing House, Bucharest, 2021, p. 247.

[13] ECJ, 14 July 1972, C-48/69, *Imperial Chemical Industries Ltd. v. Commission of the European Communities*, ECLI:EU:C:1972:70, paras. 64 and 65.

According to the ECJ, a concerted practice, although it does not have all the elements of a contract, "may inter alia arise out of coordination which becomes apparent from the behaviour of the participants"'[14].

An important condition for agreements between undertakings to be sanctioned is that they must have as their object or effect the prevention, restriction or distortion of competition within the internal market. The prevention, restriction or distortion of competition may be materialized primarily through the fixing of purchase or selling prices or any other trading conditions; the limitation or control of production, distribution, technical development or investment; the sharing of markets or sources of supply; the application to trading partners of dissimilar conditions in respect of equivalent transactions, thereby placing them at a competitive disadvantage; and the making of the conclusion of contracts subject to acceptance by the other parties of supplementary obligations which, by their nature or in accordance with commercial usage, have no connection with the subject of such contracts.

The distinction between agreements which have as their object the restriction of competition and those which produce an anti-competitive effect is essential[15]. Restrictions by object are those forms of coordination which, by their very nature, are capable of harming competition on the market, without it being necessary to conduct a detailed analysis of the actual effects produced. In this category fall, traditionally, price-fixing, the limitation of output or the sharing of markets, conduct considered particularly harmful to the functioning of the internal market (the so-called 'hard-core' agreements). By contrast, in the case of agreements which do not present an obviously anti-competitive character, their classification requires an analysis of the actual or potential effects on competition, having regard to the economic and legal context in which they operate. This distinction is particularly relevant in the context of the use of algorithms, insofar as certain mechanisms of algorithmic coordination may reveal, depending on their configuration and purpose, either a restriction by object or a restriction by effect[16].

A central element in the qualification of concerted practices in the case-law of the European Court of Justice is the elimination or reduction of competitive uncertainty. The Court has consistently held that competition law seeks to preserve a situation in which each undertaking independently determines its conduct on the market[17]. Any form of coordination which, even without the existence of a formal agreement, has the effect of replacing the risks inherent in competition with a knowing cooperation between undertakings is incompatible with Article 101 TFEU. In this sense, the elimination of uncertainty as to the future conduct of competitors constitutes a decisive criterion for identifying a concerted practice, it being irrelevant whether the coordination manifests itself through direct or indirect contacts or through technical mechanisms which facilitate the anticipation of market reactions. For instance, independent undertakings may eliminate market

[14] Gintarė Surblytė-Namavičienė, *Competition and Regulation in the Data Economy: Does Artificial Intelligence Demand a New Balance?*, Edward Elgar Publishing Limited, Cheltenham, 2020, pp. 159-160.

[15] Adriana Almășan, *Competition Law (Dreptul concurenței)*, p. 247.

[16] Ariel Ezrachi, Maurice E. Stucke, *Artificial Intelligence & Collusion: When Computers Inhibit Competition*, in Oxford Journal of Legal Studies 1, No. 37/2017, pp. 10-22.

[17] Ioan Lazăr, Laura Lazăr, *Treatise on European Union Competition Law (Tratat de Dreptul Uniunii Europene în domeniul concurenței)*, p. 214.

uncertainty through advance price announcements or by expressing complaints about the pricing policies of competitors. If the competing undertaking responds by making similar increases of its own prices, or accepts the complaints of rivals and adjusts its prices accordingly, then, in the absence of any other legitimate explanation for parallel conduct, the existence of a concerted practice may be established. In the case of agreements, by contrast, the same results are achieved through express contacts[18].

Another important element in the relations between undertakings is the exchange of information, which constitutes a particularly sensitive practice in the analysis of the compatibility of conduct with Article 101 TFEU, in particular when it reduces competitive uncertainty and facilitates the coordination of market conduct. In the context of the use of algorithms, the exchange of information may take indirect forms, through common platforms, software providers or mechanisms for automatic adaptation to data available on the market. The increase in algorithmic transparency may lead to an alignment of the conduct of undertakings without the need for direct communication, which raises additional difficulties in identifying and proving anti-competitive coordination. Nevertheless, the mere absence of an explicit contact does not exclude the application of Article 101 TFEU, insofar as the exchange of information is of a nature to cause a distortion of competition. This flexible interpretation was consolidated in recent case-law on the exchange of information; the Court held, in T-Mobile Netherlands[19], that even a single exchange of information may constitute a concerted practice when it is capable of influencing the market conduct of the undertakings involved[20]. In the context of the use of computer systems and indirect coordination, the Eturas[21] case is relevant, as the Court recognized the possibility of the existence of a concerted practice facilitated through a common IT platform, in the absence of direct contacts between undertakings[22]. In this regard, the Court demonstrated that the virtual environment and the use of technical means do not exclude the application of Article 101 TFEU, but require an adaptation of the legal analysis to modern forms of coordination.

Paragraph (3) of Article 101 TFEU regulates the exceptions to the prohibited agreements. Accordingly, agreements or concerted practices shall not be sanctioned if they satisfy the following conditions: they contribute to improving the production or distribution of goods or to promoting technical or economic progress; they allow consumers a fair share of the resulting benefit; they do not impose on the undertakings concerned restrictions which are not indispensable to the attainment of these objectives; and they do not afford such undertakings the possibility of eliminating competition in respect of a substantial part of the products in question.

In the course of technological development, agreements take on ever more diverse forms and employ multiple

[18] Robert O'Donoghue QC, Jorge Padilla, *The Law and Economics of Article 102 TFEU*, 3rd ed., Hart Publishing House, 2020, p. 222.

[19] ECJ, 4 June 2009, C-8/08, *T-Mobile Netherlands BV, KPN Mobile NV, Orange Nederland NV and Vodafone Libertel NV v. Raad van bestuur van de Nederlandse Mededingingsautoriteit*, ECLI:EU:C:2009:343, para. 60.

[20] Brenda Sufrin, Niamh Dunne, Alison Jones, *Jones and Sufrin's EU Competition Law. Text, Cases, and Materials*, 8th ed., Oxford University Press, 2023, pp. 201-202.

[21] ECJ, 21 January 2016, C-74/14, *'Eturas' UAB and Others v. Lietuvos Respublikos konkurencijos taryba*, ECLI:EU:C:2016:42, paras. 39-49.

[22] Brenda Sufrin, Niamh Dunne, Alison Jones, *Jones and Sufrin's EU Competition Law. Text, Cases, and Materials*, pp. 204-205.

mechanisms which make it difficult to determine whether they amount to an anti-competitive arrangement or not. One such mechanism currently used by undertakings in carrying out their activities is artificial intelligence. Thus, undertakings use various algorithms to improve their production, their sales and the adjustment of prices, as well as to target offers at consumers. When algorithms are used independently and underlie conduct that complies with the rules of competition, they do not give rise to the conclusion of an anti-competitive agreement. However, where undertakings use algorithms to establish an indirect or tacit agreement, the provisions of Article 101 TFEU ought to be activated. Thus, undertakings are making increasing use of artificial intelligence systems which, whilst not regulated as such in competition law, are defined, pursuant to Article 3(1) of Regulation (EU) 2024/1689[23], as a machine-based system designed to operate with varying levels of autonomy and that may exhibit adaptiveness after deployment, and that, for explicit or implicit objectives, infers from the input it receives how to generate outputs such as predictions, content, recommendations or decisions that can influence physical or virtual environments.

Although Article 101 TFEU contains no specific provisions concerning the use of algorithms or artificial intelligence, the case-law of the European Court of Justice plays an essential role in adapting the norm to new economic and technological realities. Through an evolutive interpretation of the concepts of agreement, concerted practice and exchange of information, the Court has ensured the applicability of the principles of competition law regardless of the technical form of the coordination. This approach allows for the inclusion of algorithm-facilitated conduct within the scope of Article 101 TFEU, without the need for an express amendment of the normative text, thereby preserving the efficiency and flexibility of European Union competition law.

## 3. Algorithms Used in Anti-competitive Agreements

Although no normative definition of the term ‘algorithm’ exists, which may be regarded as both an advantage and a disadvantage since it must be interpreted on a case-by-case basis, the term has been defined as a sequence of operations designed to transform input data into results[24]. The definition thus analyzed presents a high degree of generality, being formulated in an abstract and concise manner.

Undertakings may use and develop algorithms in pursuit of different purposes and/or effects. Accordingly, algorithms have been classified according to the following functional typologies[25]:

*Search function*: through the use of search engines (such as Google), information is displayed and ordered according to certain input data. This function may also be used for the search for products or services (for example, eMAG or Booking.com).

[23] ‘The Regulation as defined in Article 288 TFEU has 'general applicability'. It is binding 'in all its elements' (i.e. it is binding as to the final goal to be achieved and as to the forms and means through which that goal is to be fulfilled) and 'shall be directly applicable in each Member State', contributing, alongside directives, decisions, recommendations and opinions, to the exercise of the competences of the Union’ – see Augustin Fuerea, *The European Union Manual (Manualul Uniunii Europene)*, 6th ed., revised and enlarged, Universul Juridic Publishing House, Bucharest, 2016, p. 235.

[24] Algorithmic Competition OECD, Competition Policy Roundtable Background Note, 2023, p. 8, available on *https://www.oecd.org/content/dam/oecd/en/publications/reports/2023/05/algorithmic-competition_2be02d00/cb3b2075-en.pdf*, last time consulted on 23.01.2026.

[25] Idem, pp. 8-9.

*Recommendation function*: this is realized by correlating information about the user, collected by artificial intelligence following the user's interaction with various platforms, thereby creating a user profile matched against the characteristics of the product or service intended to be recommended. Following an analysis based on various algorithms, the product recommendation may be made by artificial intelligence (for example, Spotify or Netflix).

*Allocation function*: this may take several forms, such as the automatic execution of transactions and the distribution and allocation of supply and demand (for example, connecting a client with an available taxi, as occurs in ride-sharing applications).

*Surveillance or Monitoring function*: this consists of the observation of user behaviours and patterns with a view to identifying deviations, such as the detection of fraud in transactional data, employee monitoring (for example, Spector or Sonar Spytec) or general monitoring software (for example, Webwatcher). This category may be used by undertakings in monitoring the market, for the purpose of tracking the conduct and strategic decisions of competitors, such as prices, in which case the provisions of competition law are relevant (for example, Wiser Solutions or Intelligence Node).

*Pricing function*: this represents another function attracting the application of competition rules, as it involves the setting or recommendation of prices on the basis of data concerning the observable characteristics of customers, their behaviour or market conditions (for example, Rainmaker Group or A2i Pricecast Fuel).

*Aggregation function*: this involves the collection, classification and reordering of information from different sources, such as news aggregators (for example, Google News or nachrichten.de).

*Communication function*: this is used primarily by call-centre departments or firms and involves automated communication with consumers and/or other undertakings using chatbots; it may also take the form of virtual assistants such as Siri or Alexa.

*Filter function*: the filtering of information and data, generally in the background, such as spam filters or filters designed to exclude copyright-protected material (for example, Norton or Net Nanny).

*Information production function*: the generation of information already existing on various platforms or the automated drafting of various articles (for example, ChatGPT).

*Prediction function*: the anticipation of future behaviours or scenarios (for example, PredPol, Sickweather or scoreAhit), representing a function that may engage the application of competition law norms.

*Scoring function*: the evaluation or ordering of information, products, undertakings and/or consumers, such as online evaluation systems, evaluations that may take the form of ratings or stars provided by consumers (for example, the eBay reputation system) or consumer credit scores (for example, Kreditech).

Algorithms may be used by undertakings for development, the streamlining of certain processes, the creation of new concepts, products or services, for the monitoring and collection of information about consumers in order to make personalized offers, all conduct that is not prohibited. In the same vein, ordinary consumers may use artificial intelligence to improve certain aspects of their lives or to simplify various activities. All of these represent benefits of using artificial intelligence. From another perspective, the use of algorithms presents the following benefits: first, algorithms may constitute the basis for innovations leading to the

emergence of new or improved products. For example, products may be personalized and adapted to the specific needs of consumers. Second, algorithms may reduce costs by optimizing production processes or by increasing labor productivity[26]. Third, they may reduce barriers to entry on the market, allowing new and smaller competitors entering the market to obtain relevant market information or to develop innovative products at lower costs[27]. Fourth, algorithms may reduce consumers' search costs by giving them access to a range of suitable products, accompanied by comparable information in line with the main dimensions of competition, such as price, quality or consumer preferences[28]. Thus, price comparison platforms allow consumers an instant comparison of prices for a variety of goods and services, price monitoring tools may inform consumers as to when prices are particularly low, and artificial intelligence is used even for product recognition, facilitating the rapid identification of desired goods. Finally, algorithms may contribute to a better balancing of supply and demand, with dynamic pricing enabling their optimization in response to evolving market conditions[29].

Nevertheless, in addition to the benefits presented above, there are certain risks analyzed in the specialist literature and even regulated at European Union level through prohibited practices. Set out briefly below are only those of relevance to the subject of this article.

There are certain practices in the field of AI prohibited by Regulation (EU) No 2024/1689 which, while not directly applicable in competition law and therefore not constituting a per se infringement of Article 101 TFEU, may have implications, such as the use of systems employing subliminal techniques or intentionally manipulative techniques [Article 5(1)(a)], on the one hand, and, on the other, systems that exploit any of the vulnerabilities of and are based on the discrimination of persons or groups of persons [Article 5(1)(b)].

First, 'subliminal techniques are understood as those techniques that are impossible to be consciously perceived by a person'[30] and are most frequently encountered in advertising targeting certain individuals. The second technique – the manipulative one – consists of 'the exploitation of the emotions and vulnerabilities of persons to change their perception or behaviour (…)'[31]. This technique may also be used in the promotion of a product, appealing to the fear or anxiety of a person who suffers, for example, from a compulsive buying disorder. Second, the provisions prohibit 'the placing on the market, putting into service or use of AI systems that exploit the vulnerabilities of persons due to their age'[32], a disability or a social situation, with the purpose or effect of

[26] OECD, Artificial intelligence and competitive dynamics in downstream markets, 2025, pp. 6-8, available on *https://www.oecd.org/content/dam/oecd/en/publications/reports/2025/11/artificial-intelligence-and-competitive-dynamics-in-downstream-markets_c6e81d0e/ccf0624a-en.pdf?utm_source=chatgpt.com*, last time consulted on 23.01.2026.

[27] Idem, p. 11-13.

[28] Ariel Ezrachi, Maurice E. Stucke, *Virtual Competition: The Promise and Perils of the Algorithm-Driven Economy*, Harvard University Press, Cambridge, 2016, pp. 4-6.

[29] Idem, pp. 10-11.

[30] Raluca-Mihaela Nanu, *The European Regulation on Artificial Intelligence. Article-by-Article Commentary (Regulamentul european privind inteligența artificială. Comentarii pe articole)*, Universul Juridic Publishing House, Bucharest, 2025, p. 74.

[31] Idem, p. 75.

[32] Alin Popescu, *The Future of Our Decisions. Explained Rules, Case Studies and Examples (AI Act. Viitorul deciziilor noastre. Reguli explicate, studii de caz și exemple)*, Universul Juridic Publishing House, Bucharest, 2024, p. 146.

materially distorting the behaviour of that person or a person belonging to that group. As regards the prohibition of AI systems based on discrimination, these rely on the 'socio-economic situation, state of health or age leading to a clear modification of the person's behaviour resulting in harm to that person or another person'[33]. In this case, undertakings may use such systems for price differentiation employing criteria such as age, since persons in certain age groups may be more easily influenced than others.

## 4. The Algorithm-Facilitated Anti-competitive Agreement: Concept, Typologies and Delimitations

Agreements between undertakings may take several forms. First, agreements may be horizontal[34], involving undertakings at the same level of the production chain, such as, for example, an agreement between undertakings on the fixing of the selling price, or vertical[35], involving undertakings at different levels of the production chain, such as, for example, agreements between a producer and a distributor whereby the latter agrees not to distribute products from other producers similar to those of the former.

Secondly, we may differentiate between express agreements, on the one hand, which are directly regulated by Article 101 TFEU and take the form of agreements or concerted practices to which undertakings have arrived, involving a direct intention on the part of the undertakings to conclude the respective arrangement. And, on the other hand, tacit agreements, which may also be sanctioned if the expression of the will of one of the contracting parties to restrict competition constitutes an express or tacit invitation to the other party or parties to jointly achieve that objective[36]. These tacit agreements may also be realized through the use of an artificial intelligence system or algorithms, when through the use of such mechanisms, undertakings influence each other into adopting common conduct.

One of the most frequently encountered cases in which algorithms are used by undertakings is for the monitoring and setting of prices. Starting from this situation, it is necessary to draw a distinction between[37]:

price monitoring algorithms – monitoring the prices charged by other undertakings;

dynamic pricing algorithms – which recommend or automatically set a price based on the prices charged by competitors and/or market conditions, such as the level of demand;

personalized pricing algorithms – which adapt prices to the individual characteristics of consumers.

Pricing algorithms may have the effect of artificially increasing prices and of facilitating anti-competitive agreements. In this regard, three modalities may be identified:[38]

*Algorithms facilitating express anti-competitive agreements*: such as automated

[33] Raluca-Mihaela Nanu, *The European Regulation on Artificial Intelligence. Article-by-Article Commentary (Regulamentul european privind inteligența artificială. Comentarii pe articole)*, p. 78.

[34] Ariel Ezrachi, *Horizontal and vertical agreements, in Competition and Antitrust Law: A Very Short Introduction*, Oxford University Press, 2021, pp. 74 et seq.

[35] Ariel Ezrachi, *EU Competition Law. An Analytical Guide to the Leading Cases*, 7th ed., Ed. Hart, 2021, p. 166.

[36] Ioan Lazăr, Laura Lazăr, *Treatise on European Union Competition Law (Tratat de Dreptul Uniunii Europene în domeniul concurenței)*, p. 217.

[37] Algorithmic Competition OECD, Competition Policy Roundtable Background Note, p. 11, available on *https://www.oecd.org/content/dam/oecd/en/publications/reports/2023/05/algorithmic-competition_2be02d00/cb3b2075-en.pdf*, last time consulted on 24.01.2026.

[38] Idem, p. 13.

pricing systems based on available price data which may detect and react rapidly to deviations from coordinated conduct, thereby enhancing the stability of express agreements between undertakings, such as resale price maintenance or price-fixing.

*Algorithms used in hub-and-spoke structures*: where multiple undertakings may use the same pricing software provided by a third party, which determines pricing decisions, resulting in a hub-and-spoke structure liable to facilitate the exchange of information between competitors.

*Autonomous algorithmic tacit collusion*: where autonomous self-learning algorithms may coordinate market conduct, or at least avoid competitive outcomes, without the need for an exchange of information or explicit coordination.

Thus, through various artificial intelligence systems, undertakings may monitor the prices of competitors for similar goods or services and adjust their own prices accordingly, which entails a manual adjustment of prices. However, there are undertakings which resort to algorithms that automatically adjust prices on the basis of collected information. These adjustments may have a cascading effect, until undertakings arrive at tacit agreements, particularly when the price adjustment is carried out by algorithms. Furthermore, undertakings may deliberately allow algorithms to adjust prices in order to achieve autonomous algorithmic tacit collusion, since this is modelled primarily through reinforcement learning algorithms, which learn through autonomous trial-and-error exploration and is harder to prove. Personalized pricing, by contrast, is typically based on supervised machine learning methods, where the undertaking is directly involved, an involvement which may be proved[39].

There are several cases in which undertakings have arrived at anti-competitive agreements through the use of algorithms.

One of these is the Posters[40] case, in which two British poster retailers, Trod and GB, agreed to cease the practice of mutual price undercutting on the Amazon Marketplace platform. The cause that led to this agreement was the difficulty of manually adjusting prices on a daily basis for the purpose of continuous mutual undercutting. The implementation of this agreement was achieved through a repricing software programme, widely available through third-party providers, which was programmed to undercut other sellers but to keep the prices of the two undertakings equal. Thus, the software used created a link between the two undertakings so that their prices would remain equal but lower than those of other competitors. Even though the practice was carried out with the assistance of algorithms, human intervention was fundamentally present, due to the emails through which employees of the undertakings communicated situations where prices differed and where the software was not functioning properly. Thanks to the presence of constant communication, the British competition authority (Competition and Markets Authority) was able to establish the existence of a price-fixing agreement, characterized as a restriction of competition 'by object', and the anti-competitive conduct could be sanctioned by the application of

[39] For further details, see Algorithmic Competition OECD, Competition Policy Roundtable Background Note, available on *https://www.oecd.org/content/dam/oecd/en/publications/reports/2023/05/algorithmic-competition_2be02d00/cb3b2075-en.pdf*, last time consulted on 24.01.2026.

[40] Case 50223, Decision of the CMA, dated 12 August 2016.

competition law norms[41]. Although the aforementioned case was resolved by the British competition authority before the withdrawal of the United Kingdom from the European Union, it is relevant to EU law, as the facts predate Brexit and the legal analysis was conducted in accordance with the principles enshrined in Article 101 TFEU. Consequently, the case may be used as a reference point for the interpretation and application of European Union competition norms, including in the context of new forms of coordination facilitated by the use of algorithms.

The second is a landmark case at European Union level – the Eturas[42] case. In this matter, the company Eturas, operator of a travel booking platform, sent a message to the travel agencies using the platform informing them that discounts would be automatically capped at 3%, with the aim of normalizing competitive conditions. The European Court of Justice was referred the preliminary question of whether the use of a 'common computer system' for setting prices could constitute a concerted practice between travel agencies within the meaning of Article 101 TFEU. In its analysis, the Court started from the fundamental principle of competition law that each economic operator must independently determine its conduct on the market, any direct or indirect arrangement between operators influencing their conduct being excluded. Furthermore, the European Court of Justice emphasised that even passive forms of participation may infringe Article 101 TFEU. Nevertheless, the authorities must prove the tacit agreement that arose following the sending of the message. In such a situation, the authority may conclude that the travel agencies tacitly acquiesced in a common anti-competitive practice. This presumption must, in turn, be rebuttable and may be displaced, inter alia, by: (i) public distancing or a clear and express opposition to the Eturas initiative; (ii) notification of the competent administrative authorities; or (iii) the systematic application of a discount level exceeding the imposed cap[43].

Although no pricing algorithms in the technical sense were used in this case, it is significant insofar as a computer system was used which facilitated the influencing and modification of competitors' conduct. This ease of influence is also present in situations where algorithms are involved, and the Court's reasoning is of particular analogical value for the analysis of algorithm-facilitated coordination, as it concerns the use of a common computer system as an instrument for reducing competitive uncertainty and aligning the conduct of undertakings.

## 5. Current Challenges and Directions of Development in EU Competition Law

From the two cases analyzed above, it may be inferred that, when human activity is still present, anti-competitive agreements between undertakings are relatively straightforward to prove, even in situations where algorithms have been involved. Algorithms may be triggers for human actions leading to anti-competitive agreements, or they may be instruments through which agreements already concluded are materialized. In both cases,

[41] Friso Bostoen, *Artificial Intelligence and Competition Law*, pp. 8-9, available on *https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4655894*, last time consulted on 24.01.2026.

[42] ECJ, 21 January 2016, C-74/14, *'Eturas' UAB and Others v. Lietuvos Respublikos konkurencijos taryba*, ECLI:EU:C:2016:42.

[43] Friso Bostoen, *Artificial Intelligence and Competition Law*, pp. 10-11, available on *https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4655894*, last time consulted on 24.01.2026.

undertakings arrive at these arrangements through human involvement.

In the second scenario, we encounter possible anti-competitive agreements based exclusively on artificial intelligence systems, through autonomous self-learning algorithms capable of coordinating market conduct without the need for human involvement. In this sense, if competitors use autonomous algorithms, their actions may lead undertakings to tacit anti-competitive agreements. Another case is the use of hub-and-spoke structures, where undertakings use the same system containing identical algorithms, thereby facilitating the exchange of information. If the hub-and-spoke structure employs autonomous algorithms, then these, based on the information received, may coordinate the conduct of undertakings in a compatible manner, facilitating the emergence of anti-competitive agreements. Even if the contracts between competitors are not direct, the algorithms being interposed between the undertakings, the conduct remains attributable to them, as algorithms constitute decision-making instruments integrated into the commercial strategy of the undertakings.

The central problem consists of adapting the mechanisms established by Article 101 TFEU, through the jurisprudential developments of the European Court of Justice, to forms of algorithmic coordination in which human intervention is difficult to prove, and where the classical sanctioning instruments must be interpreted in relation to the new technological modalities of influencing competitive conduct.

This adaptation must be carried out promptly, as algorithms are at the heart not only of numerous products and services on which consumers rely, but also of the functioning of the internet as a whole. Companies develop powerful algorithms that provide the interfaces enabling communication between persons and/or the interaction between undertakings and consumers. Algorithms facilitate the large-scale processing of data, enabling online platforms to optimize decision-making processes and to improve their performance[44].

Notwithstanding the evolution of artificial intelligence and the modalities of its use on the one hand, and the extensive development of the specialist literature on algorithmic collusion on the other, the case-law of the European Court of Justice does not, to date, contain a judgment directly analyzing the use of algorithms as an instrument for the realization of anti-competitive agreements. Nevertheless, the principles developed by the Court in cases such as Eturas, Dyestuffs, Hüls, Anic Partecipazioni and T-Mobile Netherlands permit an application by analogy of Article 101 TFEU to forms of coordination facilitated by algorithms.

These cases lay the foundations of a jurisprudential evolution that will lead to the recognition of anti-competitive agreements based on algorithms, including tacit agreements or those entirely realized through autonomous algorithms. The reasoning from the Eturas and Dyestuffs cases that may be used by analogy has been presented above. As regards the Hüls[45] and Anic Partecipazioni[46] cases, the Court held that in

[44] Simonetta Vezzoso, *Competition by design*, in Björn Lundqvist, Michal S. Gal (eds.), *Competition law for the digital economy*, Edward Elgar Publishing Limited, Cheltenham, 2019, p. 93.

[45] ECJ, 8 July 1999, C-199/92 P, *Hüls v. Commission of the European Communities*, ECLI:EU:C:1999:358, paras. 161 and 162.

[46] ECJ, 8 July 1999, C-49/92 P, *Commission of the European Communities v. Anic Partecipazioni SpA*, ECLI:EU:C:1999:356, para. 121.

order to establish the existence of an infringement of Article 101 TFEU in the case of a concerted practice, three elements are required, namely: the existence of a concertation, the adoption of subsequent market conduct, and the existence of a causal link between the concertation and the subsequent market conduct. However, such a causal link is presumed where the concertation is proved and the undertakings remain active on the market[47]. This jurisprudential reasoning may be applied mutatis mutandis in the case of anti-competitive agreements facilitated by algorithms, insofar as the concertation may be achieved through computer systems or pricing algorithms, subsequent market conduct being represented by the algorithmic results, and the causal link being presumed if the undertakings remain active on the market. As regards the T-Mobile Netherlands[48] case, it was held that in the hypothesis where coordinated market conduct follows even a single instance of concertation, EU law presumes, on a rebuttable basis, the existence of a causal link between that contact and the subsequent market conduct[49]. Jurisprudential presumptions as to the existence of the causal link acquire particular relevance in the context of algorithm-facilitated coordination. First, direct and continuous contact is not necessary for an anti-competitive agreement to exist between undertakings, such contact may be achieved through algorithms. And second, pricing or market-monitoring algorithms may operate as instruments of concertation, whether through the use of a common computer system or through the alignment of the response rules of the algorithms, subsequent market conduct manifesting itself in the form of algorithmic results automatically applied by undertakings.

In these circumstances, if the existence of a form of concertation is proved and undertakings remain active on the market through the algorithms employed, the rebuttable presumption established by the case-law of the Court allows the causal link to be inferred, without it being necessary to demonstrate a continuous human intervention in the decision-making process. Such an approach is consistent with Article 101 TFEU and ensures the effectiveness of the norm in the face of digitalized coordination mechanisms, preventing the automation of anti-competitive conduct from becoming a means of evading liability.

## 6. Conclusions

The analysis conducted reveals that the use of algorithms in the activities of undertakings does not, in itself, constitute a phenomenon incompatible with European Union competition law. On the contrary, algorithms may generate significant economic benefits, such as increased efficiency, cost reduction, the stimulation of innovation and improvement of the consumer experience. Legal problems arise, however, in situations where these technological instruments are used or configured in a manner that reduces competitive uncertainty and facilitates the coordination of market conduct between competing undertakings.

[47] Gintarė Surblytė-Namavičienė, *Competition and Regulation in the Data Economy: Does Artificial Intelligence Demand a New Balance?*, p. 159.

[48] ECJ, 4 June 2009, C-8/08, *T-Mobile Netherlands BV, KPN Mobile NV, Orange Nederland NV and Vodafone Libertel NV v. Raad van bestuur van de Nederlandse Mededingingsautoriteit*, ECLI:EU:C:2009:343, paras. 51-53.

[49] Philip Hanspach, Niccolò Galli, *Collusion by Pricing Algorithms in Competition Law and Economics*, in Robert Schuman Centre for Advanced Studies Research Paper, No. 2024/06, p. 12, available on *https://ssrn.com/abstract=4732527*, last time consulted on 24.01.2026.

In this sense, anti-competitive agreements facilitated by algorithms must be analyzed within the existing conceptual framework of Article 101 TFEU, without the need to recognize a distinct legal category. The notions of agreement, concerted practice and exchange of information, as developed by the case-law of the European Court of Justice, present sufficient evolution and flexibility to cover also anti-competitive agreements based on algorithms. In this regard, the technologically neutral character of Article 101 TFEU represents an advantage, not a limitation.

Although there is, to date, no judgment of the Court expressly establishing the use of autonomous algorithms for the realization of anti-competitive agreements, cases such as Eturas demonstrate the analogical value of existing case-law. Even in the absence of automatic pricing algorithms, the Court recognized that the use of a common computer system may constitute an instrument of concertation, capable of aligning the conduct of undertakings and reducing competitive uncertainty. This logic is fully applicable to algorithm-facilitated coordination, which amplifies the speed, stability and opacity of the mechanisms of alignment of commercial strategies. The jurisprudence of the European Court of Justice also presents presumptions regarding the causal link between concertation and subsequent market conduct, established in cases such as Hüls, Anic Partecipazioni and T-Mobile Netherlands. Applied mutatis mutandis in the context of algorithmic coordination, these presumptions allow the attribution of anti-competitive conduct to undertakings even in the absence of continuous human intervention, where algorithms are integrated into the commercial strategy of those undertakings and produce effects on the market.

It is our view that EU competition law already possesses the conceptual instruments necessary to prevent and sanction anti-competitive agreements facilitated by algorithms. The current challenge does not consist in the absence of norms, but rather in their coherent application, adapted to the new realities of technological and digital evolution. The aim is to ensure that the automation of economic decisions does not become a means of evading legal liability, but remains subordinated to the fundamental principles of fair competition on the internal market.

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