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Executive Summary of the Roundtable on Algorithms and Collusion

Annex to the Summary Record of the 127th meeting of the Competition Committee

21-23 June 2017

This executive summary by the OECD Secretariat contains the key findings from the discussion held under item 10 of the 127th meeting of the Competition Committee on 23 June 2017.

More documents related to this discussion can be found at

www.oecd.org/daf/competition/algorithms-and-collusion.htm

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Executive Summary

By the Secretariat*

At its 127th meeting, the Competition Committee held a Roundtable to discuss benefits and risks of the increasing use of algorithms by companies to improve their pricing models, customise services, forecast market trends and optimise processes. The Roundtable on Algorithms and Collusion was organised as a part of the wider work stream of the Competition Committee on the digital economy and contributed to the OECD Going Digital project, which provides policy makers with tools to help economies and societies prosper in an increasingly data-driven world.

Considering the background note prepared by the OECD Secretariat, the papers prepared by the experts, the written contributions submitted by 7 countries and BIAC, as well as the discussion by delegates and expert panellists at the Competition Committee, the following key points emerged:

(1) Algorithms are sequences of commands that generate an output from a given input. Although the concept of algorithm has existed for centuries, recent improvements in computational power and data availability have enabled algorithms to perform some complex operations more efficiently than human beings, bringing substantial gains for businesses and consumers.

Algorithms are exact sequential sets of commands that are performed over a designed input to generate an output in a clearly defined format. Algorithms can be represented in plain language, diagrams, computer codes and other languages. Examples of traditional well-known algorithms include food recipes, instructions manuals and music sheets, while more complex examples include matching algorithms of online dating platforms, ranking algorithms of search engines and linear programing solvers for process optimisation.

Modern algorithms such as artificial intelligence, machine learning and deep learning use different programming principles to design intelligent agents, for instance by iteratively learning from data through a process of trial and error. While some of the underlying programming principles have already been developed by computer scientists in the 60s and 70s, only the recent availability of data and the high processing power of modern computers have enabled algorithms to obtain good results. Nowadays, machine learning and deep learning algorithms empowered with big data can solve problems of great complexity.

Algorithms have brought substantial efficiency gains to society. Businesses use algorithms to expand their predictive analysis and optimise processes in multiples ways; consumers rely on algorithms to select relevant information and improve their decision-making; and even governments and public agencies sometimes use algorithms to detect crimes and improve law enforcement. Most recent applications of deep learning have

* This executive summary does not necessarily represent the consensus view of the Competition Committee. It does, however, identify key points from the discussion at the Roundtable on Algorithms and Collusion, including the views of a panel of experts, the delegates' oral and written contributions and the background note prepared by the OECD Secretariat.

brought gains across many fields, such as biology, finances, engineering and health, where algorithms have been used to detect cancer and assist in brain surgery.

(2) Despite all efficiency gains, in some circumstances algorithms can also raise competition concerns. In particular, the roundtable identified the risk that algorithms (1) could make markets more prone to collusion, by changing structural characteristics such as transparency and frequency of interaction; and (2) replace explicit collusion with tacit coordination, by providing companies with automatic tools to implement a collusive agreement without direct communication.

Collusion is usually understood as any form of co-ordination or agreement among competing firms with the objective of raising profits, resulting in a deadweight loss. Collusion can be explicit, when maintained through an explicit agreement, or tacit, when competitors are able to coordinate strategies without communicating, by recognising their mutual interdependence.

Digitalisation is changing market characteristics that affect the likelihood of collusion, although the direction and magnitude of the effect is still not clear. It is hard to assess how algorithms will affect some of the traditional factors for collusion, such as barriers to entry and number of competing firms. There is, however, a concern that data-driven models and the use of algorithms substantially enhance market transparency and increase the frequency with which firms interact, allowing them to detect price cuts and retaliate very fast. Some experts also argued that pricing algorithms increase market stability and eliminate human bias, therefore facilitating collusive outcomes.

In addition, algorithms can have the effect of replacing explicit collusion with tacit agreements, by eliminating the need for explicit communication between competitors. Indeed, firms can program algorithms to signal and coordinate a common policy, monitor data and automatically punish any deviators. Theoretically, deep learning algorithms could even achieve tacit collusive outcomes without being explicitly programmed to do so. As a result, whereas in the past tacit collusion used to be mostly observed in markets with very few sellers, the availability of data along with the increased use of algorithms could make tacit collusion more likely in a wider range of market structures.

Some delegations provided evidence that automated pricing tools could indeed facilitate tacit collusion. The European Commission revealed that, according to its E-commerce sector inquiry, about half of respondents track online prices of competitors. The Ukrainian Competition Authority presented an investigation where price-fixing was facilitated by the exchange of information online. The Federal Antimonopoly Service of Russia reported that resellers are using price-setting algorithms which pose a threat of facilitating co-ordination, while similar conclusions were reached by a study of the Competition Commission of Singapore. Finally, one of the experts discussed how publishing real-time prices online enabled petrol stations to unilaterally raise prices in Australia, Chile and Germany.

(3) Competition law covers instances where algorithms amplify explicit collusion, but could be more difficult to apply in relation to pure forms of tacit collusion, which is generally not covered by antitrust rules. Given the concern that algorithms make tacit collusion more frequent, there is an ongoing debate about the need to rethink some fundamental antitrust concepts.

Competition law is currently well suited to address instances where algorithms are used as tools to implement more efficiently an explicit agreement. Even if the presence of advanced technologies makes the analysis more complex, agencies can nevertheless rely

on existing competition rules to establish an infringement. This was successfully done by the Department of Justice of the US and the Competition and Markets Authority of the UK, who prosecuted online sellers in the Amazon marketplace for programing dynamic pricing algorithms to act in conformity with their (explicit) agreement.

Nonetheless, algorithms can also facilitate anti-competitive behaviours that are not covered by current antitrust rules, such as pure forms of tacit collusion. As a result, there is an ongoing debate about a possible enforcement gap in competition law: on the one hand, some suggest that traditional antitrust concepts could be reconsidered in order to deal with the risks of algorithms; on the other hand, others claim that the importance and the magnitude of the problem is still largely unknown, making it hard to conclude for the existence of an enforcement gap.

The ongoing debate about rethinking the principles of competition law takes place in at least three distinct dimensions. Firstly, some experts question whether the legal treatment of tacit collusion needs adjusting in a world where this conduct is observed on a large scale. Secondly, as computer technology enables indirect forms of communication – such as fast iterative price changes that result in price convergence – competition experts wonder whether it is necessary to develop a more clear definition of agreement for antitrust purposes. Thirdly, given the recent developments of machine learning and deep learning, the weak link between algorithms and human beings puts in question the liability of the creators, users or benefiters of algorithms.

(4) In light of the challenges raised by algorithms, competition authorities may opt to adapt existing antitrust tools to tackle collusion or to experiment a number of alternative counter measures that have been proposed by experts. Whatever approach agencies decide to follow, agencies should act with caution, implement changes progressively and share their experience

In order to tackle algorithmic collusion, competition authorities can rely on traditional *ex-ante* measures that could help addressing some of the current concerns. For example, agencies may find it useful to conduct market studies and investigations, which could help identify markets where algorithms might pose more serious concerns and select the most appropriate regulatory or enforcement solutions. In addition, authorities could rely on *ex-ante* merger control to review coordinate effects of transactions in markets which are not too concentrated but where pricing algorithm are widely used. Another option would be to use commitments and remedies to prevent the use of algorithms as a facilitating practice.

Apart from traditional tools, a few competition experts have proposed other less orthodox measures to address the problem. These include market solutions, such as empowering consumers with algorithms to counteract co-ordination by suppliers. For instance, price aggregators and collective purchase systems may allow consumers to fight back tacit agreements and to buy only from firms in the competitive fringe. Other counter measures could include de-acceleration measures to prevent fast price changes that do not give enough time for consumers to react; policies to prevent disclosure of information that might be of little value for consumers; and a lenient approach to secret discounts, which could help breaking tacit agreements.

Although several other counter-measures were discussed at the roundtable, delegates and experts recognised that many of these options may have limitations in their effectiveness and could potentially have negative consequences for the good functioning of digital markets. Therefore, given the limited knowledge and experience in this area, any policy

change should be progressive and approached with caution, carefully weighting the benefits of tackling collusion against the costs of over-enforcement. In this respect, many agreed that international co-operation to share knowledge and experience with other agencies might be of great value.

(5) Apart from the risk of enhancing collusion, algorithms are associated with several other risks in the way they select information and affect consumer behaviour. The increasing complexity behind computer codes may hinder consumers from taking self-protection actions, resulting in consumer harm and potentially serving as an argument for regulatory intervention.

Algorithms select information and support decision-making in a growing variety of areas, potentially posing several other risks that could compromise the efficient functioning of digital markets. Algorithms can be programmed to manipulate rating systems, to collect content in violation of privacy and property rights, or to provide product recommendations that may bias consumers' decisions. In the domain of antitrust, there are also risks of exclusionary abuse – for instance when search or ranking algorithms are programmed to exclude a competitor – and exploitative abuse – when pricing algorithms use sensitive consumer data to implement first-degree price discrimination.

Some of the general risks of algorithms may be hard to address exclusively through market means. Indeed, as most algorithms are trade secrets and involve complex program codes, consumers typically find themselves in a context of imperfect information that limits their ability to avoid potentially harmful data products. Data-driven business models are also sometimes associated with economies of scale, economies of scope and network effects that restricts the number of suppliers developing proprietary algorithms, reducing further consumer choice.

The risks inherent with algorithms, combined with the limited ability of consumers to understand the way they operate, could justify some form of regulatory intervention. In this context, there is an ongoing discussion about the potential benefits and limitations of possible regulatory measures, such as the development of programing principles to increase the transparency of algorithms' codes, the creation of auditing mechanisms for algorithms, and even the establishment of rules requiring algorithms to comply by design with data protection and antitrust law.

(6) Despite the possible concerns about the societal impact of algorithms, regulatory intervention may hinder investment and innovation in digital markets, pose substantial enforcement costs and possibly fail in achieving some of the policy objectives. If regulatory measures are deemed absolutely necessary, policy makers should carefully design regulations that minimise competitive impact.

Any regulations restricting the way computer codes are written or requiring companies to publicly disclose their proprietary algorithms are likely to reduce incentives for investment and innovation. Such interventions could also have other unintended consequences on digital markets, where the absence of overly restrictive regulations and the prevalence of a competitive-friendly environment have brought substantial gains for consumers. Moreover, supervising extensive and complex computer codes would impose substantial enforcement costs, possibly exceeding the resources of most regulators.

In addition to the negative consequences of over enforcement, regulating algorithms could actually turn out ineffective in addressing some of the competition problems identified. For instance, if as a result of regulatory intervention companies would be forced to publicly disclose algorithms and to increase price transparency, this could

actually facilitate collusion by enabling companies to easily copy each other's pricing algorithms. Furthermore, the roundtable was only able to identify a limited number of regulatory measures that could potentially tackle tacit collusion, many of which would be likely to pose substantial harm on the competitive process.

In light of all these concerns, if any regulatory intervention must be implemented, policy makers should opt for smart regulations that establish the outer boundaries of algorithmic activity, without undermining market competition. As an alternative to actually regulating algorithms, regulators could audit data. This alternative, apart from having considerably lower enforcement costs, would allow regulators to verify whether companies are setting prices using sensitive private information collected for anti-competitive purposes.