

**DIRECTORATE FOR FINANCIAL AND ENTERPRISE AFFAIRS  
COMPETITION COMMITTEE**

**Algorithms and Collusion - Note from the European Union**

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## *European Union*

### 1. Background

1. Any set of rules about turning digital inputs into digital outputs is an "algorithm". An algorithm is decision-making software. As for other types of decision-making, the quality of the decisions – the outputs – depends on the data that was fed into the algorithm, and on the quality of the algorithm itself. Algorithms are at the core of the functioning of many digital products, from the first digital calculators of long ago to today's machine-tools and medical equipment.
2. When an algorithm is programmed to amend its own decision-making rules to account for past experience, it becomes a self-learning algorithm. Search engines and self-driving cars, for example, are based on self-learning algorithms. Self-learning algorithms can be relevant to competition policy in two ways. First, a particular result, or output, from a self-learning algorithm is more difficult to understand for a human, as it may be based on a large number of factors, vast amounts of data and complex rules that the human may not be able to reproduce. Yet humans – and, through them, legal entities – must be held accountable for the consequences of the algorithms they choose to use, including in the area of competition policy.<sup>1</sup> Second, access to data streams is key to crafting a good self-learning algorithm: the more data there is, the more learning there is. This relates to the competition implications of data accumulation.<sup>2</sup>
3. Another development which is relevant to competition policy is that the online economy is becoming increasingly personalised, thanks in large part to data collection and algorithms. While personalisation can be good for consumers in some circumstances, it can also have more ambiguous effects. In large part, online personalisation today rests on the principle that a consumer will like to see content which is similar to what he or she (and similar consumers) consumed in the past. In the case of personalised recommendations for music or everyday tangible products, for example, this is often perceived as useful. But when it comes to recommending newspaper articles, for instance, personalisation can limit the range of views that consumers are exposed to. This is the so-called "filter bubble" or "echo chamber" phenomenon.<sup>3</sup>
4. The consequences of personalisation for internet users are also ambiguous when it comes to personalised ads relying on algorithms. According to a European Commission

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<sup>1</sup> Margrethe Vestager, "Algorithms and competition", speech at the Bundeskartellamt 18th Conference on Competition, Berlin, 16 March 2017.

<sup>2</sup> See the European Commission's presentation at the OECD hearing on big data on 29 November 2016, at [www.oecd.org/daf/competition/big-data-bringing-competition-policy-to-the-digital-era.htm](http://www.oecd.org/daf/competition/big-data-bringing-competition-policy-to-the-digital-era.htm).

<sup>3</sup> Margrethe Vestager, "A healthy democracy in a social media age", speech at the launch event of ALL For Democracy, 7 June 2017.

"Eurobarometer" survey, when asked about internet companies using their personal information to tailor advertisements, 42% of respondents said they were comfortable with this, while 53% said they were uncomfortable about this.<sup>4</sup>

5. Sometimes the consequences of personalisation are even more ambiguous and complex, as in the case of personalised pricing (prices matching each individual's maximum willingness to pay) and risk-based pricing (prices matching the supplier's risk from serving the customer, for example in insurance markets).<sup>5</sup> Data and algorithms are at the heart of these types of personalisation as well. Again, access to data streams is key to crafting personalisation algorithms. And again, there may be competition implications from the extraction of personal data and from the accumulation of data (personal or not).<sup>6</sup>

6. As the cost of capturing and storing data, and the cost of computing power, continue to fall, the use and importance of data and algorithms in the online economy can be expected to further increase.

7. While it is useful to have this broader context of the online economy in mind, this contribution focuses on algorithms that are used to track and/or adapt prices. It does not cover algorithms used for personalisation purposes (including personalised pricing). Since the topic of this roundtable is "Algorithms and collusion", this contribution does not cover the treatment of algorithms under the European Union (EU) rules on abuse of dominance (Article 102 of the Treaty on the Functioning of the European Union, or TFEU).

## 2. Algorithmic pricing

8. Many firms monitor their competitors' and retailers' prices. In the offline world, this is done by observing prices in person, or buying price tracking data from specialised suppliers, or talking to customers who report better offers that they see elsewhere. These monitoring mechanisms are cumbersome, costly, not entirely effective, and do not take place in "real time".<sup>7</sup>

9. By contrast, online prices are highly transparent. Monitoring can be done at short time intervals and at a low cost. Firms can use software to automatically monitor competitors' prices almost in real time, and adapt prices (or "reprice") accordingly. The software's repricing methods can be based on more or less complex algorithms, and more or less comprehensive user-defined rules and strategies. Thus repricing software is highly configurable by each user, and would normally be configured to reflect the user's pricing

<sup>4</sup> Special Eurobarometer survey no. 431 on data protection, June 2015, available at [http://ec.europa.eu/commfrontoffice/publicopinion/archives/ebs/ebs\\_431\\_en.pdf](http://ec.europa.eu/commfrontoffice/publicopinion/archives/ebs/ebs_431_en.pdf), page 39.

<sup>5</sup> On personalised pricing, see the Commission Staff Working Document accompanying the Final Report on the E-commerce Sector Inquiry, document SWD(2017) 154 final of 10.5.2017, para. 647: "Personalised pricing by retailers based on data collected on online behaviour of individuals is at this stage rare (reported by 2 % of respondent retailers)." Personalised pricing is different from dynamic pricing, which is about changing prices in view of evolving estimates of the supply and demand relationship for a particular product. To the extent that personalised pricing exists, now or in the future, it could undermine algorithm-enabled tacit collusion, as personalised prices constitute essentially secret discounts.

<sup>6</sup> Footnote 2 above.

<sup>7</sup> Although as stores introduce "electronic shelf labelling", many price labels attached to store shelves may soon become electronic displays that are controlled and updated electronically.

objectives in view of its minimum price, inventory volume, storage costs, seller reputation/reviews, the selection of certain (benchmark) competitors, etc.

10. The remainder of this contribution addresses some of the possible competition implications of pricing algorithms in a vertical context (part 3) and in a horizontal context (part 4). In a horizontal context, after setting out some background (4.1), this contribution discusses algorithms used to monitor agreed prices (part 4.2), to implement pre-existing explicit collusion (part 4.3), as a means of communication to engage in explicit collusion (part 4.4), and to engage in tacit collusion (part 4.5). In some instances the emphasis is on the monitoring function of pricing software, while in other instances the emphasis is on the repricing function.

11. The topics discussed in this contribution are not exhaustive. This contribution sets out preliminary considerations that may be relevant to the debate at this time. This contribution is not a statement of the European Commission's position for the future (hereafter "the Commission").

### 3. Algorithms in a vertical context

12. Under EU competition law, "resale price maintenance" (RPM) consists in a supplier and a retailer agreeing on the retailer's downstream price in the form of a fixed or a minimum sales price. In the EU, RPM is prohibited as a "restriction by object" in violation of Article 101 TFEU (hereafter Article 101).<sup>8</sup> By contrast, EU competition law allows suppliers to "recommend" sales prices to their retailers, provided that the suppliers do not insist on adherence to the recommended prices through any kind of pressure or incentives, as that would result in RPM.<sup>9</sup>

13. Algorithms have at least three potential implications for vertical cases such as RPM cases.

14. First, price monitoring algorithms can be used to detect deviations from a fixed or minimum resale price (RPM). In such cases, algorithm-enabled price monitoring does not constitute an RPM offence as such but forms part of the RPM infringement, as it contributes to the effectiveness of the RPM.<sup>10</sup>

15. Second, with regard to recommended prices, "increased price transparency through price monitoring software enables easier detection of those retailers that deviate from manufacturers' pricing recommendations. It could therefore allow manufacturers to retaliate against retailers that do not comply with pricing recommendations and, therefore, limit the incentives of retailers to deviate from such pricing recommendations in the first place".<sup>11</sup> If algorithm-enabled price monitoring allows a supplier to pressure a retailer to

<sup>8</sup> Guidelines on Vertical Restraints, OJ C 130 of 19.5.2010, p. 1, para. 48; and Guidance on restrictions of competition "by object" for the purpose of defining which agreements may benefit from the De Minimis Notice, document SWD(2014) 198 final, revised version of 3.6.2015, part 3.4, with further references.

<sup>9</sup> Ibid.

<sup>10</sup> At the same time, there may be legitimate reasons for a producer to observe retail prices, for example setting the wholesale price at the right level or estimating the retail market value of its products.

<sup>11</sup> Commission Staff Working Document accompanying the Final Report on the E-commerce Sector Inquiry, document SWD(2017) 154 final of 10.5.2017, para. 607.

stick to a "recommended" price, the supplier would be actually turning that "recommended" price into a fixed resale price (RPM).

16. Third, when retailer A adheres to fixed or minimum resale prices (RPM) and is being monitored by retailer B using algorithms, retailer B may match A's price. In this way, one retailer's use of RPM may spread high prices to other retailers who may not be similarly engaged in RPM.<sup>12</sup>

## 4. Algorithms in a horizontal context

### 4.1. Background

17. With regard to the horizontal perspective, according to the Commission's E-Commerce Sector Inquiry Staff Working Document,

"53% of the respondent retailers track the online prices of competitors, out of which 67% use automatic software programmes for that purpose. Larger companies have a tendency to track online prices of competitors more than smaller ones. The majority of those retailers that use software to track prices subsequently adjust their own prices to those of their competitors (78%)."<sup>13</sup>

18. In this section, explicit collusion is distinguished from tacit collusion. Under EU competition law, explicit collusion refers to "agreements" and "concerted practices" within the meaning of Article 101.<sup>14</sup>

19. Under Article 101, an "agreement" requires some kind of communication and sense of mutual commitment, so that the parties realise that they reached a "meeting of minds" or a "concurrence of wills". According to the *Bayer* judgment, the concept of agreement "centres around the existence of a concurrence of wills between at least two parties, the form in which it is manifested being unimportant so long as it constitutes the faithful expression of the parties' intention".<sup>15</sup>

20. By contrast, a "concerted practice" means "a form of coordination between undertakings, which, without having been taken to the stage where an agreement properly so-called has been concluded, knowingly substitutes for the risks of competition, practical cooperation between them", in particular "any direct or indirect contact between such operators by which an undertaking may influence the conduct on the market of its actual or potential competitors or disclose to them its decisions or intentions concerning its own conduct on the market".<sup>16</sup>

<sup>12</sup> See also the Commission press release entitled "Antitrust: Commission opens three investigations into suspected anticompetitive practices in e-commerce", no. IP-17-201, 2 February 2017, para. 8.

<sup>13</sup> Commission Staff Working Document accompanying the Final Report on the E-commerce Sector Inquiry, document SWD(2017) 154 final of 10.5.2017, para. 149.

<sup>14</sup> While this contribution does not explicitly focus on the notion of "decision of an association of undertakings" under Article 101, the issues discussed in this contribution may apply to decisions of associations of undertakings *mutatis mutandis*.

<sup>15</sup> Case T-41/96 *Bayer*, ECLI:EU:T:2000:242, para. 69.

<sup>16</sup> Case 40/73 *Suiker Unie*, ECLI:EU:C:1975:174, paras. 26 and 174.

21. At the same time, Article 101 "does not deprive economic operators of the right to adapt themselves intelligently to the existing and anticipated conduct of their competitors".<sup>17</sup> "Every producer is free to change his prices, taking into account in so doing the present or foreseeable conduct of his competitors".<sup>18</sup> This "intelligent adaptation" is also known as "tacit collusion".

22. From an economic perspective, both explicit and tacit collusion can raise prices. From a legal perspective, what distinguishes them is the element of *communication* between competitors, because Article 101 does not catch unilateral behaviour. Whether communication leads to an agreement or a concerted practice matters little, as both notions "catch forms of collusion having the same nature which are distinguishable from each other only by their intensity and the forms in which they manifest themselves".<sup>19</sup>

#### 4.2. Algorithms that are used to monitor agreed prices

23. Price monitoring algorithms can be used to detect deviations from the price agreed among horizontal competitors.<sup>20</sup> In such cases, algorithm-enabled price monitoring could form part of the infringement. Moreover, for the purpose of the fines, the Commission may increase the "gravity" percentage – an element of the calculation of the fine – when the firms "rigorously" implemented their agreement or concerted practices.<sup>21</sup> Algorithm-enabled price monitoring can constitute such "rigorous" implementation.

#### 4.3. Algorithms that are used to implement pre-existing explicit collusion

24. If firms were to engage in explicit collusion through any means of communication and then set their own pricing algorithms so as to implement it, such behaviour would be no different from setting prices manually to implement a collusive price in the offline world. Moreover, in both cases, it is the explicit collusion through communication that constitutes the infringement, regardless of implementation.

25. In the *Eturas* case, for example, several Lithuanian travel agencies used a "common online travel booking system".<sup>22</sup> The system administrator sent an electronic message to some of the travel agencies, proposing to implement a software rule limiting the possibility of discounts of more than 3% in the online booking system. (Although the travel agencies concerned would not be prevented from granting discounts greater than 3%, they would be required to take additional technical steps in order to do so.) The European Court of Justice found that this would constitute a concerted practice under Article 101 if it were proven that the travel agencies were aware of that message. The

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<sup>17</sup> Ibid.

<sup>18</sup> Case 48/69 *Imperial Chemical Industries*, ECLI:EU:C:1972:70, para. 118.

<sup>19</sup> Case C-8/08 *T-Mobile*, ECLI:EU:C:2009:343, para. 23.

<sup>20</sup> Commission Staff Working Document accompanying the Final Report on the E-commerce Sector Inquiry, document SWD(2017) 154 final of 10.5.2017, para. 608.

<sup>21</sup> See e.g. Commission Decision of 15.7.2015 in case AT.40098 *Blocktrains*, para. 83, and the Guidelines on the method of setting fines, OJEU C 210, 1.09.2006, p. 2.

<sup>22</sup> Case C-74/14 *Eturas*, ECLI:EU:C:2016:42.

case focused on awareness of the message, i.e. the initial concertation, not on its subsequent implementation through the software rule.

#### 4.4. Algorithms that are used to engage in explicit collusion

26. In the offline world, colluding about using a particular pricing formula is a violation of Article 101.<sup>23</sup> Subject to the circumstances, the same could be true of online competitors colluding about using particular repricing parameters and strategies in their pricing algorithms to lead to aligned and higher prices than absent the collusion. Moreover, in a so-called "hub and spoke" situation, such collusion may also take place through a third party, which would equally raise concerns under Article 101. Going even further, if competitors were to outsource their pricing decisions to one and the same third party, this would also raise Article 101 concerns, by analogy with the Article 101 treatment of common agents.<sup>24</sup>

27. In another scenario, pricing algorithms might be used to signal pricing intentions or proposals to competitors. In the recent *Container Shipping* case (2016), the Commission took the view that communicating tentative price increases through press releases could raise competition concerns under Article 101. If signalling were to take place through pricing algorithms – perhaps through coded messages that are "understood" by the other algorithm<sup>25</sup> – this would also raise Article 101 concerns. If pricing practices are illegal when implemented offline, equivalent practices will be illegal when implemented online.

28. There may be yet another scenario. One could wonder whether pricing algorithms could, without explicit instructions to do so, engage in explicit collusion with each other. This would require algorithms to achieve a sense of communication (for concerted practices) and bargaining and mutual commitment (for reaching "agreement"). If this is or were to become possible in the future, the firms using such algorithms would remain liable for their behaviour. It is up to the firms using algorithms to ensure that their algorithms do not engage in illegal behaviour.<sup>26</sup>

#### 4.5. Algorithms that are used to engage in tacit collusion<sup>27</sup>

29. The recent debate concerning the competition implications of algorithms has focused in large part on tacit collusion. Is algorithmic pricing making tacit collusion more pervasive and more effective, and if so, what would be the appropriate response from a competition enforcement perspective?

<sup>23</sup> Provided that all the other conditions of Article 101 are met. See e.g. case T-48/00 *Corus*, ECLI:EU:T:2004:219, para. 82.

<sup>24</sup> E.g. Commission Decision no. 73/212 of 11 May 1973 in case IV/791 *Société Commerciale des Potasses et de l'Azote (SCPA) and Kali und Salz (formerly VDK)*, OJEU L 217, 6.8.1973, p. 3.

<sup>25</sup> OECD secretariat, "Algorithms and Collusion", 16 May 2017, para. 72.

<sup>26</sup> Margrethe Vestager, "Algorithms and competition", speech at the Bundeskartellamt 18th Conference on Competition, Berlin, 16 March 2017, on the idea of "compliance by design".

<sup>27</sup> See also Commission Staff Working Document accompanying the Final Report on the E-commerce Sector Inquiry, document SWD(2017) 154 final of 10.5.2017, para. 608.

30. One response could be to examine whether algorithmic pricing is indeed making tacit collusion more pervasive and more effective. On one side of the argument, it would seem that algorithmic pricing can enable fast and stable price matching, including in markets where it would otherwise be unlikely to take hold. On the other side of the argument, algorithms do not remove the need for some of the basic conditions for tacit collusion.

- First, tacit collusion requires sufficiently homogeneous products. When sold online, even identical products can become differentiated in terms of delivery costs, delivery time, and the seller's reputation, for example.
- Second, tacit collusion requires effective retaliation, which in turn requires spare capacity. A capacity-constrained firm cannot initiate a price war as a means of retaliation to enforce tacit collusion.
- Third, before engaging in tacit collusion, a firm would need to decide that it is a better course of action than competitive pricing, especially if competitive pricing leads to drastically larger sales volumes.

31. A second potential response – which has been argued – would be that the market itself may come up with technological solutions allowing consumers to defeat sellers' algorithm-enabled tacit collusion. For example, "consumer algorithms" – in practice, price comparison, price tracking and price forecasting websites and apps – may be able to effectively crawl the web to find low prices, recommend whether to buy now or later, or recommend to buy strategically (i.e. from "maverick" sellers). Indeed the online economy has already produced technological solutions to phenomena that consumers did not like, for example e-mail services that filter "spam"; ad blockers and tracker blockers; and "virtual private network" services to circumvent geoblocking.

32. Yet such technological solutions may materialise too late, or indeed not at all. Accordingly, competition authorities cannot rely on the possibility that technological solutions might come up to fix competition problems. Competition authorities need to stand ready to detect new forms of anti-competitive behaviour and take action in the early stages, where necessary.

33. A third possible response would be to consider taking an expanded interpretation of the notion of "communication", in order to bring cases of algorithm-enabled price matching within the scope of Article 101. For this purpose, one could argue that through repeated interactions, two firms' pricing algorithms could come to "decode" each other, thus allowing each one to better anticipate the other's reactions. However, the case-law is clear that Article 101 "does not deprive economic operators of the right to adapt themselves intelligently to the existing *and anticipated* conduct of their competitors" (paragraph 21 above). Short of signalling (as discussed in paragraph 27 above), it is therefore not obvious that more sophisticated tools through which a firm merely observes another firm's price and draws its own conclusion would qualify as "communication" for Article 101 purposes. At the same time, at this stage, one cannot fully rule out the possibility that more creative and novel types of interactions could in certain situations meet the definition of "communication".

34. A fourth response to the debate concerning algorithm-enabled tacit collusion could be to reconsider the current case-law according to which tacit collusion is legal under EU competition law. There are however good reasons for the current case-law on this point. Any reconsideration of the current state of the law would notably need to ensure that one can – short of price regulation – formulate a sensible and enforceable antitrust rule requiring firms to set their prices *without regard* to market prices. In any

case, it would be useful to continue to tackle tacit collusion through merger enforcement<sup>28</sup> and by preventing RPM.<sup>29</sup>

## 5. Conclusion

35. To a large extent, pricing algorithms can be analysed by reference to the traditional reasoning and categories used in EU competition law.

36. In a vertical context, price monitoring algorithms may be used by suppliers to monitor fixed or minimum prices, or to monitor "recommended" prices so as to exercise pressure on, or provide incentives to, the retailer to respect those recommended prices, thereby turning them into fixed or minimum sale prices (RPM). Finally, the use of price monitoring/matching algorithms by one retailer may have the effect that higher prices spread from sellers that engage in RPM to other sellers.

37. In a horizontal context, algorithms may be used (a) to monitor agreed prices, (b) to implement pre-existing explicit collusion, or (c) as a means of communication to engage in explicit collusion, including through "hub and spoke" collusion and signalling. For the moment, it seems too early to discuss in more depth the possibility of algorithms engaging in explicit collusion with each other on their own initiative.

38. More generally, the treatment of pricing algorithms under EU competition law rests on two important principles.

- First, if pricing practices are illegal when implemented offline, there is a strong chance that they will be illegal as well when implemented online.
- Second, firms involved in illegal pricing practices cannot avoid liability on the grounds that their prices were determined by algorithms. Like an employee or an outside consultant working under a firm's "direction or control", an algorithm remains under the firm's control, and therefore the firm is liable for its actions.<sup>30</sup>

<sup>28</sup> See Guidelines on the assessment of horizontal mergers under the Council Regulation on the control of concentrations between undertakings, OJEU C 31, 05.02.2004, p. 5, from para. 39, on "coordinated effects".

<sup>29</sup> Guidelines on Vertical Restraints, OJEU C 130, 19.05.2010, p. 1, para. 224: "RPM may facilitate collusion between suppliers by enhancing price transparency on the market, thereby making it easier to detect whether a supplier deviates from the collusive equilibrium by cutting its price."

<sup>30</sup> Under EU competition law, a firm is liable for the actions of its employees, and outside consultants working "under its direction or control": see e.g. case 100/80 *Musique Diffusion Française*, ECLI:EU:C:1983:158, para. 97, and case C-542/14 *VM Remonts*, ECLI:EU:C:2016:578, para. 27.