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

Algorithms and Collusion - Note by the United States

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*More documents related to this discussion can be found at
www.oecd.org/daf/competition/algorithms-and-collusion.htm.*

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1. Introduction

1. Advances in technology continue to drive economic growth and transform markets around the world. Consumers have benefitted from this growth in the form of free or low-priced services, better quality goods and services, more choices, and innovative new products. Businesses have developed new tools that use data in increasingly sophisticated ways as more sectors of the economy connect to one another and to consumers.

2. The Antitrust Division of the U.S. Department of Justice (“DOJ”) and the U.S. Federal Trade Commission (“FTC”) submit this paper as part of the Committee’s broad look at the role of competition policy in the digital age. At the November 2016 hearing on *Big Data: Bringing Competition Policy to the Digital Era*, the Committee identified for future discussion the risks associated with the use of data and computer algorithms in enabling new forms of collusion. In this paper, we address the application and limits of U.S. antitrust analysis to business conduct involving technologically advanced tools such as pricing algorithms. After introducing those tools, we address the antitrust principles that inform emerging pricing issues involving the use of algorithms.

2. Technology-aided pricing

3. Firms have long employed implicit or explicit sets of rules to set prices, and these rules or formulas have been implemented by individuals. The new practice that has drawn the attention of academics and policy makers is when price-setting is done not by individuals, but by computers. A computer algorithm is a detailed step-by-step procedure that allows a computer to solve a problem. A pricing algorithm instructs the computer to set the price of an item for sale, and can be written to rely on competitors’ prices and demographic or other information about the customer.¹ Pricing algorithms are dynamic, allowing prices to respond quickly to changes in market circumstances. Many firms use algorithms to set pricing on the internet because there are vast pricing data to sort through and changing prices is relatively inexpensive.²

¹ This discussion assumes that the pricing algorithm is a program written by humans. Although computers equipped with artificial intelligence (AI) or machine learning could in theory make decisions that were not dictated or allowed for in the programming, these scenarios seem too speculative to consider at this time.

² It is important to distinguish the potential anticompetitive aspects of using algorithmic pricing from other potentially competitively neutral or procompetitive aspects of algorithmic pricing and data analysis. For example, algorithmic pricing can be used to price discriminate among buyers: it could generate one price to a customer browsing on her mobile phone in New York City and a different price for someone shopping online using a home computer in Florida. Algorithmic pricing that leads to price discrimination – without incorporating competitor data – is unlikely to raise competition concerns. Price discrimination facilitated by computer algorithms should be analyzed using the same framework as price discrimination in other contexts. A more complete discussion of the U.S. Agencies’ views on price discrimination can be found in the November 2016 Note by the United States, “Roundtable Discussion on Price Discrimination,” DAF/COMP/WD(2016)69, https://www.ftc.gov/system/files/attachments/us-submissions-oecd-other-international-competition-fora/price_discrimination_united_states.pdf.

4. Algorithmic pricing can, of course, be highly competitive by facilitating rapid competitive response. Indeed, a core principle of free market competition is that firms adjust pricing in response to competitive conditions, including the prices charged by competitors. Antitrust law views such behavior as generally procompetitive. That prices move up or down more quickly in response to competition or consumer demand through the use of computerization does not change this basic principle.

5. On the other hand, the speed and ease of algorithmic pricing may affect an individual firm's behavior where such systems are widely used. For instance, rapid automated pricing programs likely reduce the benefit that a firm would otherwise enjoy from either discounting (in a free market) or defecting from collusive pricing (in a cartelized market). Especially in online commerce, such price deviations can be quickly detected and responded to.

6. Note that the implementation of pricing policies by one firm's employees is unilateral conduct (whether it factors in the prices of competitors or not) and is not actionable under Section 1 of the Sherman Act³ without evidence establishing an agreement with another firm over the purpose or effect of a pricing algorithm.⁴

3. Competition Policy Related to Price Setting

7. U.S. antitrust laws safeguard the competitive process; they are not price-control statutes and do not provide any basis for price regulation.⁵ This is an important feature of U.S. antitrust law. There are compelling policy reasons to intervene in markets only to deter anticompetitive conduct. Challenging market outcomes or structure—rather than anticompetitive behavior—replaces the competitive process with regulation. Doing so is error-prone given antitrust enforcers' limited information relative to a decentralized market. It “requires antitrust courts to act as central planners, identifying the proper price, quantity, and other terms of dealing—a role for which they are ill-suited.”⁶ Such intervention may also overlook that, in some circumstances, monopoly power can be “an important element of the free-market system.”⁷

8. It is especially important not to interfere with independent pricing decisions because of the important benefits to consumers of price competition and the crucial role that market price-setting plays in efficiently allocating resources.⁸ “There is general consensus that the basic objective of competition policy is to protect competition as the

³ 15 U.S.C. § 1.

⁴ The use of algorithms by a firm to track retail prices or monitor compliance with resale pricing policies exceeds the scope of this paper, which focuses on their use by competitors in a horizontal relationship.

⁵ See October 2011 Submission of the U.S. Department of Justice and the U.S. Federal Trade Commission on Excessive Prices (DAF/COMP/WP2/WD(2011)65, <https://www.ftc.gov/sites/default/files/attachments/us-submissions-oecd-and-other-international-competition-fora/1110excessivepricesus.pdf>).

⁶ *Verizon Commc'ns Inc. v. Law Offices of Curtis V. Trinko, LLP*, 540 U.S. 398, 408 (2004).

⁷ *Id.* at 407.

⁸ See October 2011, *supra* note 5.

most appropriate means of ensuring the efficient allocation of resources—and thus efficient market outcomes—in free market economies.”⁹

4. Collusion vs. Interdependent Pricing

9. Under U.S. law, an illegal restraint need not directly set final prices; an agreement that has the purpose and effect of “raising, depressing, fixing, pegging, or stabilizing the price” also violates the Sherman Act.¹⁰ Moreover, collusive schemes may be informal, arising from a common understanding among competitors that falls short of an express agreement. Importantly, collusion, in the legal sense, differs from mere interdependent behavior among firms in a horizontal relationship.¹¹ As a result, U.S. courts have addressed the factual question of when “coordinated” pricing results from an actionable agreement among competitors (illegal) or from mere interdependent behavior (legal).

10. Agreements among competitors that do not directly set prices may be illegal *per se* if the agreements directly affect prices, such as agreeing to adhere to a formula for setting prices. Similarly, industry-wide use of delivered pricing¹² may constitute illegal concerted action when adherence to a formula aligns competitors’ prices, whether proven by direct evidence of such an agreement¹³ or by circumstantial evidence that the firms used additional conduct to ensure compliance with the pricing formula.¹⁴ Without proof of collusion or evidence that the knowing parallel adoption of pricing formulas narrowed the range of prices over time, parallel pricing conduct may be outside the reach of the antitrust laws.¹⁵

4.1. Pricing Algorithms and Collusion

11. Computer-determined pricing may be susceptible to coordination, just as human-determined pricing can be. Below we discuss different scenarios in which algorithmic pricing could implement coordinated anticompetitive price changes.

⁹ See Organization for Economic Co-operation and Development, COMPETITION POLICY AND EFFICIENCY CLAIMS IN HORIZONTAL AGREEMENTS, OECD/GD (96) 65, Paris (1996), <https://www.ftc.gov/sites/default/files/attachments/us-submissions-oecd-and-other-international-competition-fora/1999--Mini-Roundtable%20on%20Oligopoly.pdf>.
<http://www.oecd.org/dataoecd/1/4/2379526.pdf>.

¹⁰ *United States v. Socony-Vacuum Oil Co.*, 310 U.S. 150, 223 (1940).

¹¹ See May 1999 Submission of the U.S. Department of Justice and the U.S. Federal Trade Commission on Oligopoly (DAFFE/CLP/WD(99) 13, <https://www.ftc.gov/sites/default/files/attachments/us-submissions-oecd-and-other-international-competition-fora/1999--Mini-Roundtable%20on%20Oligopoly.pdf>. Section 7 of the Clayton Act forbids mergers or acquisitions that, among other things, substantially increase the risk of anticompetitive coordination. The implications of widespread use of pricing algorithms for merger analysis are beyond the scope of this paper.

¹² “Basing point pricing (also known as delivered pricing) refers to a system in which a buyer must pay a price for a product inclusive of freight costs that does not depend on the location of the seller.” OECD, Glossary of Statistical Terms.

¹³ *Am. Chain & Cable Co. v. FTC*, 139 F.2d 622 (4th Cir. 1944).

¹⁴ *Cement Institute v. FTC*, 333 U.S. 683, 710 (1948).

¹⁵ *Boise Cascade Corp. v. FTC*, 637 F.2d 573 (9th Cir. 1980) (no liability where evidence showed that prices varied due to market forces).

12. Starting with a simple case, an agreement among competitors to use a common computer system to establish or implement an illegal pricing agreement is a violation of U.S. law. For example, in 1994 the DOJ settled accusations that six airlines used a jointly owned computerized online booking system, the Airline Tariff Publishing Company (ATP), to communicate and set collusive airline fares. Although ATP provided a means for the airlines to disseminate fare information to the public, it also provided a forum for the airlines to engage in essentially private dialogues on fares. Certain features of the system enabled the airlines to reach overt price-fixing agreements, and “facilitate[d] pervasive coordination of airline fares short of price fixing.”¹⁶

13. Extending this example, algorithmic pricing may similarly be a mechanism for implementing a collusive agreement between individuals or firms. For example, competing firms could agree to use pricing algorithms that enhance their joint profits by setting higher prices than either firm would have charged using only its own rules or algorithm. In this case, the anticompetitive agreement is between the firms, and the algorithms are simply the means of effectuating the agreement and the mechanisms through which the collusive prices are set.

14. To provide an actual example, the DOJ has charged two executives and an e-commerce retailer in a price-fixing conspiracy in which the conspirators utilized pricing algorithms to fix the prices of posters sold on the Amazon Marketplace. On this platform, a retailer prices its own products, and Amazon determines the order in which to display products in response to a customer query. While this determination is based on a number of factors, the retailer offering the lowest price for the product that is most responsive to the search query typically appears first in Amazon’s search results, which is the most desirable spot for generating sales. To date, one executive and the e-commerce retailer have pleaded guilty for subverting competition for poster sales on the Amazon Marketplace by agreeing to match prices for specific posters sold on the Amazon marketplace.¹⁷

15. The conspirators used commercially available algorithm-based pricing software, which continually collects competitor pricing information and prices a product based on a set of rules implemented by the seller. In order to match prices, one conspirator, with the agreement of the other, programmed its algorithm to find the lowest-price offered by a non-conspiring competitor for a particular poster, and then set its poster price just below that, and another conspirator set its algorithm to match the first conspirator’s price. By agreeing to fix prices for certain posters, the conspirators eliminated competition among themselves for these sales. Such competition would have likely driven the poster prices down further. The conspirators monitored the effectiveness of their pricing algorithms by spot checking prices, and enforced their price-fixing agreement. Once the pricing algorithms were in place, however, the conspiracy was, to a large extent, self-executing.

¹⁶ United States v. Airline Tariff Publishing Co., 836 F. Supp. 9 (D.D.C. 1993); See <http://www.usdoj.gov/atr/cases/dir23.htm>, described in DAF/COMP/WD(2007)112, Roundtable on Facilitating Practices in Oligopolies, Note of the United States (October 4, 2007), <https://www.ftc.gov/sites/default/files/attachments/us-submissions-oecd-and-other-international-competition-fora/usfp.pdf>.

¹⁷ See <https://www.justice.gov/atr/case/us-v-daniel-william-aston-and-trod-limited>; <https://www.justice.gov/atr/case/us-v-david-topkins>. As part of its investigation, the DOJ received MLAT assistance from the United Kingdom’s enforcement authorities, in coordination with the Competition & Markets Authority.

16. Just as competitors cannot communicate directly with one another to set prices or restrict output, they also cannot use an intermediary to reach such an unlawful agreement¹⁸. This is sometimes called a “hub-and-spoke” conspiracy. In this scenario, a purchaser or supplier (the “hub”) reaches separate agreements with each competitor (the “spokes”), with additional evidence demonstrating a common understanding among the competitors (the “rim”), for instance by assurances from the hub that each spoke would adhere to the agreement only if all the others did.¹⁹

17. Extending this scenario to the topic at hand, if competing firms each entered into separate agreements with a single firm (for instance a platform) to use a particular pricing algorithm, and the evidence showed they did so with the common understanding that all of the other competitors would use the identical algorithm, that evidence could be used to prove an agreement among the competitors that violates U.S. antitrust law. The lack of direct communication among the competitors would not be a bar to finding an unlawful conspiracy.

18. Absent concerted action, independent adoption of the same or similar pricing algorithms is unlikely to lead to antitrust liability even if it makes interdependent pricing more likely. For example, if multiple competing firms unknowingly purchase the same software to set prices, and that software uses identical algorithms, this may effectively align the pricing strategies of all the market participants, even though they have reached no agreement. Even when firms do not all adopt identical algorithms, the use of algorithms may increase price transparency and help to stabilize prices. However, enforcement agencies normally police the risk for interdependence through merger control (due, in part, to the difficulties in crafting an adequate remedy to interdependence) while prosecuting collusion directly. This distinction remains appropriate when evaluating the use of algorithms.

4.2. A Broader View of the Implications of Widespread Use of Pricing Algorithms

19. Broadly speaking, the collection and use of data are evolving rapidly and in tandem with the use of algorithms. Large data sets that companies analyze to reveal patterns or trends, especially involving human behavior, are inputs to algorithms in many circumstances. Algorithms cannot exist without large, and increasing, amounts of data. Although it is well outside the scope of this roundtable and paper to discuss the topic, the Agencies have examined issues surrounding large data sets. The FTC in particular has tools to study and maintain current knowledge on new trends in technology that impact its competition and consumer protection enforcement work.

¹⁸ See, e.g., *Interstate Circuit, Inc. v. United States*, 306 U.S. 208 (1939) (dominant movie theater chain orchestrated agreements with movie distributors to set minimum prices for first-run exhibitions and to ban double features at night, using a common letter sent to all distributors to set forth the terms of the conspiracy).

¹⁹ *Toys “R” Us, Inc. v. FTC*, 221 F.3d 928, 932-34 (7th Cir. 2000) (holding an agreement among competing toy suppliers orchestrated by a toy retailer per se unlawful); See also *United States v. Apple, Inc.*, 791 F.3d 290 (2d Cir. 2015), *cert denied*, 136 S. Ct. 1376 (2016) (holding per se unlawful price-fixing conspiracy among competing book publishers orchestrated by e-book retailer and implemented in part through separate contracts between retailer and each publisher).