

ALGORITHMS AND COORDINATED EFFECTS
University of Oxford Center for Competition Law and Policy
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Remarks of Commissioner Terrell McSweeney¹

Good afternoon, everyone. I am happy to be here with you today at the University of Oxford. I'd like to thank the Centre for Competition Law and Policy for organizing this event. I am going to talk today about the rise of algorithmic pricing and its implications for competition enforcement.

First of all, I think it is important to step back and recognize just how important algorithms are in modern society. Every email we send relies on algorithms to get where it needs to go. Every Internet search we run relies on algorithms to provide us with relevant results. Every app on a smart phone is a bundle of computer code, or in other words, an algorithm. Without algorithms, online markets wouldn't exist because we wouldn't have computers, much less a functioning Internet. If you've ever so much as used a calculator, you know how useful algorithms can be.

An algorithm literally flew me over here to participate in this panel. After all, the autopilot feature on commercial airlines that makes flights safer and more efficient is just an advanced algorithm. Its benefit is that it is able to process vast quantities of constantly changing flight data and make instantaneous adjustments. More data, faster reactions.

In most things, "more data, faster reactions" is an unqualified good. But for pricing, the consumer welfare effects are not as straightforward. Pricing algorithms raise three issues from a competition perspective. First, they may increase the effectiveness of overt collusion. Second, they may facilitate coordinated interaction in the absence of a traditional "agreement" between competitors. And third, they may enable price discrimination strategies that lead to higher prices for certain groups of customers.

¹ Remarks as prepared for delivery. The views expressed in this speech are my own and do not necessarily reflect those of the Commission or any other Commissioner.

Collusion

We already have a real-world example of the first concern on the books. In 2015, the U.S. Department of Justice brought a price-fixing case against two retailers for aligning their pricing algorithms to increase the online price of posters.² In that case, humans reached an agreement to fix prices. The pricing algorithms were the tools used to implement the agreement. Well, you may say, what's the big deal? That's just naked price fixing. Antitrust enforcers have clear legal authority to challenge price fixing, so how does the use of pricing algorithms change anything?

The answer is that pricing algorithms may make price fixing attempts more frequent and potentially more difficult to detect. Traditionally, maintaining a collusive scheme requires identifying cheating among participants, responding to new market developments, and avoiding detection by antitrust officials. Algorithms could be used in an attempt to overcome these challenges, such as by automating conspirators' responses to changing market developments or speeding them up, mitigating the need for ongoing coordination between the participants.

Coordinated Interaction

The second concern with pricing algorithms is that they may facilitate coordinated interaction – sometimes called tacit collusion or parallel accommodating conduct. In their book, *Virtual Competition*, Professors Maurice Stucke and Ariel Ezrachi discuss a number of different mechanisms for coordination, which they refer to as “collusion scenarios.”³ One possibility is that multiple competitors might use algorithmic pricing software offered by the same company. Another is that firms' nominally independent algorithms may simply gravitate collectively towards higher prices on their own.

² See Press Release, U.S. Dep't of Justice, Former E-Commerce Executive Charged with Price Fixing in the Antitrust Division's First Online Marketplace Prosecution (Apr. 6, 2015), <http://www.justice.gov/opa/pr/former-ecommerce-executive-charged-price-fixing-antitrust-divisions-first-online-marketplace>.

³ ARIEL EZRACHI & MAURICE E. STUCKE, *VIRTUAL COMPETITION: THE PROMISE AND PERILS OF THE ALGORITHM-DRIVEN ECONOMY* (2016).

Bruno Salcedo recently put out a paper discussing a dynamic economic model he developed to look at algorithmic pricing by multiple firms.⁴ Salcedo's results suggest that pricing algorithms can be "an effective tool for *tacit* collusion" with the potential to lead to near-monopolistic pricing.⁵ The model assumes that firms are able to "decode" their competitors' algorithms. Salcedo included a specification in which firms were given an option to mask their algorithms to prevent decoding. The firms in the model chose not to exercise the option – preferring instead to allow their algorithms to be decoded after a time by their competitors.⁶

Concerns about algorithmic tacit collusion are still largely theoretical at this point. Nonetheless, recent examples suggest that the concern is not fanciful. Earlier this month, the *Wall Street Journal* published an article entitled "Why Do Gas Station Prices Constantly Change? Blame the Algorithm."⁷ The article examined the use of artificial intelligence software by European gas stations. One gas station operator candidly told the *Journal* that its decision to use the software was prompted by the effects of a years-long price war with its competitors.⁸ A pilot study involving that same operator found that stations running the software averaged 5% higher margins.⁹

A few caveats are in order. First, the decision of the gas station operator to use artificial intelligence software, on its own, is not an antitrust violation. Second, without more information, it's hard to know whether the reported higher margins are the result of coordinated effects. Another possibility is that the software enabled the gas station operator to engage in unilateral price discrimination – a topic I will turn to in a moment. Nonetheless, the takeaway from the article is that artificial intelligence (AI) pricing software appears to have changed pricing practices in certain European retail gas markets.

⁴ Bruno Salcedo, Pricing Algorithms and Tacit Collusion 3, Nov. 1, 2015, <http://brunosalcedo.com/docs/collusion.pdf>.

⁵ *Id.* at 5, 50.

⁶ *Id.* at 4.

⁷ Sam Schechner, *Why Do Gas Station Prices Constantly Change? Blame the Algorithm*, WALL ST. J., May 8, 2017, <https://www.wsj.com/articles/why-do-gas-station-prices-constantly-change-blame-the-algorithm-1494262674>

⁸ *See id.* ("Danish oil and energy company OK hired a2i Systems in 2011 because its network of gas stations was suffering from a decade-old price war").

⁹ *See id.*

Price Discrimination

The third concern with pricing algorithms is that they may enable price discrimination strategies that lead to higher prices for certain groups of customers. The CEO of an AI pricing firm basically said as much in the *Wall Street Journal* article, claiming that his firm's software was "about making margin on people who don't care, and giving away margin to people who do care."¹⁰ Of course, price discrimination isn't just about raising prices to customers who "don't care." It works just as well for customers who care very much, but are nonetheless willing to pay a higher price because they lack the practical ability to go elsewhere.

At the same time, price discrimination can produce real consumer benefits. Price discrimination can increase market output, which we as competition enforcers generally view as a positive. Indeed, some products and services would not be offered at all without price discrimination.

As an example, imagine it costs \$20 for a movie theater to screen a film. Hannah is willing to pay \$14 to see the film. Emily is willing to pay \$8. If the theater charges \$14, only Hannah will buy a ticket. If it charges \$8, both Hannah and Emily will buy tickets – but the theater still won't collect enough money to cover its cost. The only way for the theater to screen the film is to figure out a way to charge Hannah more than Emily.¹¹ The calculus gets a bit complicated, but it turns out the answer is \$8 popcorn. Everybody wins.

Pricing algorithms will undoubtedly lead to an increase in price discrimination. Whether that is a good or a bad thing for consumers is likely to depend on facts that are specific to individual markets and individual algorithms.

Algorithms' Pros and Cons and the Implications for Competition Enforcers

In sum, pricing algorithms present potential pros and cons for consumers. So why are algorithms' effects ambiguous when it comes to pricing, when they are positive in so many other

¹⁰ *Id.* at 7.

¹¹ See Andrew Odlyzko, Privacy, Economics, and Price Discrimination on the Internet, Fifth International Conference on Electronic Commerce (July 27, 2003), at 5-8, <https://ssrn.com/abstract=429762>.

areas? The simple answer is that pricing is an activity for which our human limitations may generate positive social externalities in many cases.

Vigorous competition occurs in many markets despite the fact that those markets have attributes that make them vulnerable to coordinated conduct.¹² In many instances, this is essentially a collective failure of market participants to solve the prisoner's dilemma. All firms would be better off if they paralleled one another on pricing, but each individual firm is better off undercutting its competitors to earn additional sales. Our antitrust laws are designed to encourage this failure – up to and including jail time for executives who attempt to “solve” the prisoner's dilemma by colluding with competitors.

The great promise of algorithms and AI is their ability to transcend human limitations and produce better outcomes by processing more data, faster. The issue is that “better outcomes” from the perspective of firms won't always align with better outcomes from the perspective of consumers. If algorithms enable firms to “solve” their unique prisoner's dilemmas without resorting to overt collusion, that would be great news for them but bad news for consumers.

What policy and enforcement choices should we make when it comes to pricing algorithms? It's probably easier to start with what choices we *shouldn't* make. We shouldn't outlaw pricing algorithms. Algorithms are right up there with the printing press in terms of their contributions to our modern economy. They have the potential to produce real consumer benefits and to make more products available to more people. After all, the entire premise of market competition is that firms will respond to changes in the market and that those responses will generally benefit consumers. Algorithms enable firms to identify market changes better and respond to them more quickly. In a great many cases, that will be an unambiguously good thing.

If pricing algorithms are found to reduce barriers to coordinated interaction under certain conditions, then enforcers may need to consider stepping up our aggressiveness with respect to coordinated effects analysis. Continuing research will be incredibly valuable in this area. I think it would be helpful to understand whether algorithms are resulting in coordinated effects and, if so, under what conditions. And as the technology running the algorithm becomes smarter and

¹² The U.S. antitrust agencies describe the conditions that make a market conducive to coordinated interaction in their 2010 Horizontal Merger Guidelines. See U.S. DEP'T OF JUSTICE & FED. TRADE COMM'N, 2010 HORIZONTAL MERGER GUIDELINES § 7.2.

more autonomous, research should focus on whether it tends to achieve a collusive outcome without being programmed to do so.

I applaud the excellent work that has already been done. And I am encouraged that this has become an important topic of discussion among antitrust practitioners. Next month the OECD will be holding a roundtable on algorithms and collusion¹³ and I look forward to reading the contributions of participants. We have a lot to learn about the effects of pricing algorithms and AI. Further research will contribute to better and more effective competition enforcement in this area.

One thing I can say with confidence is that the rise of pricing algorithms and AI software will require changes in our enforcement practices. We, as enforcers, need to understand how algorithms and AI software work in particular markets. At the FTC, we have taken steps to expand our in-house expertise by adding the Office of Technology, Research and Investigations, which includes technologists and computer scientists.¹⁴ As I have said before, this is just a first step. I believe that technologists will come to play an increasing role in cases involving pricing algorithms and AI in the future.

¹³ Organization for Economic Development, Algorithms and Collusion, <http://www.oecd.org/competition/algorithms-and-collusion.htm>.

¹⁴ See Jessica Rich, BCP's Office of Technology Research and Investigation: The next generation in consumer protection, Fed. Trade Comm'n business blog, Mar. 23, 2015, <https://www.ftc.gov/news-events/blogs/businessblog/2015/03/bcps-office-technology-research-investigation-next>.