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Beware Algorithms That Could Collude on Prices

In a study, two pricing algorithms learned on their own to raise prices together to unfairly high levels



Companies are increasingly using algorithms to help them set prices. PHOTO: ISTOCK

By Matthew Kassel

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It's one thing for algorithms to set prices. It's another thing for algorithms to unfairly raise prices.

A new study shows that this can indeed happen, at least theoretically.

Companies are increasingly using algorithms to help them set prices for air travel, ride sharing, gasoline and a range of other goods. Now, researchers have conducted a series of computer simulations in which pricing algorithms learned, through trial and error and without communicating directly, to collude in maintaining prices above levels that would be expected in open competition. The only instruction the algorithms were given was to maximize profits, though the researchers didn't tell them how to do this.

To prove that the algorithms were colluding and not just randomly landing, in unison,

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on inflated prices, the researchers forced one algorithm in each simulation to cut its price. The algorithms then engaged in a price war—but eventually returned together to higher prices. Such behavior, experts say, is a hallmark of collusion, in which companies that have agreed to raise prices above competitive levels occasionally cheat on the collusive arrangement but ultimately fall back in line.

“The question, as we are delegating key managerial tasks to machines, is what shall we expect?” says Emilio Calvano, an author of the study and a professor of economics at the University of Bologna. “One option is that markets will function better—lower prices, perhaps. Or machines can find clever ways to extract more money out of consumers’ pockets. And collusion is a clever way of doing exactly that.”

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Prof. Calvano’s co-authors are Vincenzo Denicolò and Sergio Pastorello of the University of Bologna and Giacomo Calzolari of the European University Institute.

The study, published in December by the Centre for Economic Policy Research, is an important advance in the literature on pricing algorithms, says Joseph Harrington, a professor of business economics and public policy at the University of Pennsylvania’s Wharton School.

“It was a study I was hoping to see,” he says. “This work is the first step toward establishing that algorithms can collude in reasonably complex environments.”

Whether or not they can learn to collude in real markets, however, is still an open question, Prof. Harrington says. To conduct their study, the researchers used relatively basic algorithms—powered by the same kind of artificial intelligence that is used to play chess—in environments that don’t exactly replicate existing online retail markets. To bolster the idea that collusion is possible, Prof. Harrington says, algorithms will need to be tested in more advanced and complex environments.

Still, the findings raise serious questions regarding antitrust regulations in industries where algorithmic pricing is in use or is likely to be used in the future, says Susan Athey, a professor at the Stanford Graduate School of Business who focuses on the economics of technology.

The study's algorithms engaged in what the researchers describe as "tacit collusion," a sort of price fixing that takes place without any explicit communication. Experts say companies could run into legal problems if they were to agree to use algorithms with the intention of allowing the algorithms to collude on prices. The problem is that such surreptitious arrangements could be hard to detect, primarily because parallel behavior among algorithms doesn't necessarily imply explicit collusion.

The researchers are aware of such concerns and are currently at work on a paper that seeks to address policy issues associated with algorithmic collusion.

Mr. Kassel is a writer in New York. He can be reached at reports@wsj.com.

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