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Algorithmic Collusion: Competition Implications and Anticompetitive Evidence in Brazil

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Introduction

The use of algorithms by companies is increasingly influencing business and the competitive environment. Pricing algorithms, for instance, enable companies to set prices promptly and efficiently. This sort of tool allows for the inclusion of many factors[2] in a pricing strategy. Rather than only making adjustments according to competitors' prices, numerous techniques allow algorithms to adjust or differentiate prices for each consumer.

The discussion about the role of automated algorithms in our daily lives and businesses is interdisciplinary, as it brings together subjects from Economics, Law, Philosophy, and Data Security, in addition to several fields of Artificial Intelligence. In 2017, the OECD issued a document titled *Algorithms and Collusion: Competition Policy in the Digital Age*.[3] The paper discusses how algorithms are changing competition and facilitating collusion between companies.

This paper is aimed at investigating the implications for competition and the evidence in Brazil of the use of such pricing tools, particularly that concerning collusion among competing companies. For decades, several industries (such as the hotel, fuel and airline sectors) have been using computer programs for pricing their products and services; algorithm negotiation, for instance, is ubiquitous in the transactions of the financial market. For example, dynamic pricing in the airline industry dates to the early 1980s and is said to have been started by American Airlines (McAfee & Te Velde, 2007).[4] The company charged prices by employing newly created systems for flight reservations that changed the price per available seat as the aircraft reached total capacity. The use of pricing algorithms has increased with online commerce and digital platforms. Schwalbe (2018) states that while, on the one hand, widespread use of algorithms may change structural market conditions in favor of collusion,[5] algorithms may increase the competitive pressure[6] on the other. Therefore, the answer to this question depends on the case at hand.

Algorithmic Collusion and Competition Implications

It is worth differentiating the ways algorithms are implemented when analyzing the implications of algorithmic collusion. Schwalbe (2018) argues that, in addition to changing structural market conditions, algorithms can be used to facilitate collusion; i.e. algorithms may be considered as a so-called facilitating device. In such a case, algorithms are an additional tool for coordinating a cartel.

As to the impacts of algorithms on competition, Ezrachi & Stucke (2016) suggest categorizing four scenarios for algorithmic collusion, namely: (1) messenger, (2) hub-and-spoke, (3) predictable agent, and (4) autonomous machine. In the messenger scenario, firms use

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[1] Chief economist at CADE. This document is an extended version of an article written by the author, which was published in Portuguese. Available at https://www.conjur.com.br/2021-mai-28/defesa-concorrencia-precificacao-colusao-algoritmica-evidencias-implicacoes-concorrencia.

[2] Such as competitors' prices, expected demand, and numerous market data.

[3] OECD (2017) Algorithms and Collusion: Competition Policy in the Digital Age. Available at https://www.oecd.org/daf/competition/Algorithms-and-colllusion-competition-policy-in-the-digital-age.pdf.

[4] McAfee, R.; Velde, V. (2007) Dynamic pricing in the airline industry. Mimeo.

[5] For instance, price transparency can incraease if algorithms collect and analyse prices charged by competitors. Consequently, it is possible to identify price deviations resulting from collusion more quickly and easily, and punishment mechanisms can become more effective.

[6] As an example, algorithms can reduce transaction costs, reduce market frictions, and provide customers with more information for decision-making.

algorithms to implement a cartel. In this case, an explicit agreement between the companies is necessary. Therefore, algorithms are employed here only as new technology to coordinate old-fashioned cartels. In other words, algorithms can provide new ways of facilitating collusion, for instance, through a secret, hard-to-detect exchange of information between companies.

In the second scenario, the hub-and-spoke, many companies (spokes) can use the same algorithm and centralize their decisions through the same company (hub) that offers algorithmic pricing. Thus, they could reach a collusive balance if the algorithm establishing the prices maximized everyone's profits. As with the messenger scenario, a hub-and-spoke network requires that companies somehow communicate and agree to choose a specific hub (Schwalbe, 2018). This kind of agreement is equivalent to a regular hub-and-spoke cartel and is nothing new to competition law. Former FTC Commissioner Ohlhausen argued that if the word "algorithm" can be changed to "a guy named Bob" in a sentence, then it may be treated as a traditional hub-and-spoke cartel (Ohlhausen, 2017).[7] The CMA (2018), UK's competition authority, says the situation can be more sensitive if companies in a specific market entrust their prices to the same algorithmic pricing provider, allowing the provider to coordinate their prices without these companies' knowledge.

The third scenario developed by Ezrachi & Stucke (2016) was the predictable agent, in which each company creates their own pricing algorithm. As the algorithms monitor and track other algorithms' prices, they create an interdependence over time. Algorithms may be quick to react so that if a company lowers its prices, other companies will also immediately lower their prices. In this case, competitive pressure lessens, and it is more likely for collusive behavior to emerge. According to Schwalbe (2018), algorithms may work as price guarantees,[8] which also lessens competitive pressure, "since algorithms can react very quickly, there is hardly any time during which the price of a competitor can be undercut to increase market share and gain additional revenue and profit." By reacting predictably, algorithms explicitly announce their intentions, making it easier for competitors to figure out what is happening, potentially leading to tacit collusion. Nonetheless, Schwalbe (2018) raises questions, with examples, about what happens if companies use different algorithms, which would react to market conditions a little differently. Schwalbe thus concludes that even if companies use identical algorithms, each of them would probably look at things and learn about them differently, as they usually have stochastic features.

The last scenario is the autonomous machine. In it, an algorithm can get so complex and sophisticated that, to maximize profits, it could learn from experience and reach a result of tacit collusion that was unintended by its users in any way and is very unlikely to be detected by an antitrust authority (CMA, 2018).[9] According to Ezrachi & Stucke (2016), "with the industry-wide use of computer algorithms, we may witness conscious parallelism in markets with many more players, where collusion previously would have been unstable."[10] In this context, the legal literature assumes that achieving this profit-maximizing collusive outcome is easy or even unavoidable. However, Schwalbe (2018) states that it is unclear whether an autonomous machine scenario would lead to this kind of result.[11]

[7] Ohlhausen, M.K. (2017) Should We Fear The Things That Go Beep In the Night? Some Initial Thoughts on the Intersection of Antitrust Law and Algorithmic Pricing, FTC.

[8] At first glance, these price guarantees may look pro-competitive. Usually, consumers do not complain when they can buy at a guaranteed lower price. Nonetheless, these same guarantees may help in making collusive practices more stable, which favors cartels' price-fixing practices and reduces the incentive to cut prices (Hay, 1982). Hay, G. (1982) Oligopoly, Shared Monopoly, and Antitrust Law, Cornell Law Review 28: 439-481.

[9] Competition and Markets Authority (CMA) (2018). Pricing algorithms. Economic working paper on the use of algorithms to facilitate collusion and personalised pricing.

[10] Ezrachi, A., Stucke, M. (2016) Virtual Competition, Harvard University Press, Harvard, MA.

[11] Schwalbe, U. (2018) Algorithms, machine learning, and collusion. *Journal of Competition Law & Economics*: 14, Issue 4: 568–607.

Schwalbe (2018) states that for such collusion to occur, much depends on what these algorithms can do and whether they can coordinate their behavior or learn to communicate with each other. In this sense, many recent studies have tried to understand if this kind of collusion is possible and whether algorithms could achieve this result autonomously. For instance, the number of players in a market is a decisive factor for the incidence of collusion, even if it happens autonomously. Horstmann et al. (2016) conducted a meta-analysis that showed that, amongst the oligopolies they simulated, markets with two players were significantly more likely to have tacit collusion than markets with three or four players.[12]

Currently, evidence of antitrust conduct in the predictable agent or autonomous machine scenarios (i.e. in which there is no human component) that could result in (tacit) collusion and the offenders' punishment is mostly abstract and theoretical.[13] However, in a recent paper, Assad et al. (2020) provided the first empirical evidence of the relationship between algorithmic pricing and competition.[14] Initially, the authors clarified that there is no direct evidence of anticompetitive behavior by any algorithmic software firm or petrol (gasoline) brand mentioned in their study. They analyzed the German retail market for petrol, which in mid-2017 relied heavily on algorithmic pricing software. The authors had frequent access to public data on prices. Since the researchers did not know exactly when the software started to be used, they identified which petrol stations employed algorithmic pricing software by testing for structural breaks.[15]

Based on this, they examined the effects of algorithmic pricing on stations' profit margins, estimating that by adopting algorithmic pricing the German retail petrol stations had a 9 percent increase in margins – but only in non-monopoly markets. As for duopoly markets, they found that market-level margins did not change when only one of the two stations employed algorithmic pricing; however, margins increased by 28 percent in markets where both stations did adopt it. It is noteworthy that margins did not increase until about a year after market-wide adoption, suggesting algorithms in this market have learned over time how not to compete, achieving tacit collusion.

These outcomes suggest that adopting AI for pricing purposes may bring about more collusive practices (in this case, tacit collusion). The results shed light on previously abstract and theoretical discussions. Now, these matters need to be examined and considered according to concrete cases and the current legislation. Antitrust authorities must remain watchful and continue analyzing the topic at national and international forums and through investigations and technical studies.

Algorithmic Collusion and Anticompetitive Evidence in Brazil

In Brazil, there are some cases involving the use of pricing algorithms. However, in all cases the algorithms were deployed by the parties to facilitate their agreement to collude and act anticompetitively, and therefore count as an infringement under Brazilian antitrust law

[12] Horstmann, N.; Kramer, J.; Schnurr, D. (2016) Number Effects and Tacit Collusion in Experimental Oligopolies. Mimeo. Potters & Suetens (2013) found similar results. Potters, J.; Suetens, S. (2013) Oligopoly Experiments in the Current Millennium. Journal of Economic Surveys: 27, 439-460.

[13] See CMA (2018) and Gal (2018). Gal, M. S. (2018) Algorithms as Illegal Agreements, forthcoming in Berkeley Technology Journal.

[14] Assad, S.; Clark, R.; Ershov, D.; Xu, L. (2020) Algorithmic Pricing and Competition: Empirical Evidence from the German Retail Gasoline Market, CESifo Working Paper, nº 8521. Veljanovski (2020) highlights that these study's findings are broadly consistent with the simulation predictions of Calvano et al. (2020). Calvano, E.; Calzolari, G.; Denicolò, V.; Pastorello, S. (2020) Artificial Intelligence, Algorithmic Pricing, and Collusion. American Economic Review, 110 (10): 3267-97. Recently, Klein (2021) also shows the results of a computer simulation of self-learning algorisms between two firms with sequential price changes. Klein, T. (2021) Autonomous algorithmic collusion: q-learning under sequential pricing. Rand Journal of Economics, 52 (3): 538–599.

[15] Veljanovski (2020) points out that in Assad et al. (2020)'s paper "*no information was available on which petrol stations used algorithmic software and if so, what software was used. The study inferred the presence of algorithmic software pricing from changes in the pattern of prices over time thus raising simultaneity concerns (which it tried to control for). Moreover, collusive pricing in brick-and-mortar retail petrol outlets is well documented in the absence of algorithmic pricing*."

(Federal Law nº 12.529/2011).[16]

For example, the Administrative Council for Economic Defense ("CADE"), the Brazilian Competition Authority, has already convicted a cartel for using software to monitor and control the establishment of an agreement in the market for driving schools and driver licensing agents. The agents intended to employ algorithms and software to operate the cartel.[17] Over the course of investigations, CADE observed that, between 2002 and 2011, ADESBO (the association of driving schools of the city of Santa Bárbara D'Oeste) and the software company "Criar" were involved in an anti-competitive agreement in Santa Bárbara D'Oeste, a town in the state of São Paulo. The agreement aimed at dividing the market, coordinating prices, restraining the entry of new players, and exercising direct or indirect coercive power on cartel members. According to the rapporteur of the case, the cartel was established after ADESBO hired "Criar" to develop a system for driving school enrolment to equally distribute customers to do medical and psychological tests for obtaining driver license services.

However, ADESBO started to operate the system developed by "Criar" – who agreed in advance to provide the system under contractual terms – to distribute learners amongst driving schools and driver licensing agents. In other words, ADESBO used the system to divide up the market; to share sensitive information and customers' personal information amongst market players; to issue invoices based on agreed prices; to alter several price sheets that were agreed to by driving schools and licensing agents; to establish entry barriers by defining terms and conditions that imposed penalties on those that did not adhere to the driving school enrolment system and the agreed prices; and to regulate the market, taking advantage of the system's monitoring features. Thus, in 2016, CADE's Tribunal found all defendants on the case guilty of cartel activities. The penalties included fines that totaled USD 254,779. ADESBO paid fines for cartel establishment; driving school and driver licensing agents paid fines for participating in the cartel and consenting to price and market standardization; and "Criar" paid fines for facilitating and making feasible the anticompetitive conduct.

On another proceeding, CADE understood that the use of a tool developed by the company ATPCO was evidence for the existence of a cartel in the Brazilian airline sector, as airline companies used it to coordinate and fix readjusted prices, which occurred a few days after a meeting of cartel members. Concerning ATPCO,[18] CADE investigated potential anticompetitive behavior established via the information exchange system used by the company. ATPCO signed a Cease and Desist Agreement with CADE, committing not to use tools that facilitate the prompt exchange of information amongst competitors.

In the ATPCO case, competitors used the system to indicate to one another intended future prices for the market. Since prices are non-binding, if a company, suggesting the higher price did not have the approval of other players, the company would not have to present said price to customers. Therefore, it allowed for "cheap talk" to occur, i.e. it does not affect the company's reputation when it suggests price increases.

In addition, competitors knew the price rise was conditional on all players agreeing upon and indicating future price rises. Therefore, customers would not be able to migrate from the higher-price competitor to the lower-price competitor as a response to the increase since there is an expectation that all competitors will simultaneously readjust their prices in the future. By allowing the sharing of information amongst competitors and regarding non-binding future prices, such conduct facilitates collusion.

[16] Similarly, Veljanovski (2020) shows that there have been no cases involving a cartel or anticompetitive practices generated by self-learning pricing algorithms in the EU. Veljanovski, C. (2020) Pricing Algorithms as Collusive Devices. Available at https://ssrn.com/abstract=3644360.

[17] See Administrative Proceeding 08012.011791/2010-56.

[18] See Administrative Proceeding 08012.002028/2002-24.

Schwalbe (2018) mentions that cartel members have employed and will always employ the available technology to form a cartel – be it telephone, email, computer software, among others. In this case, the technology used is different (i.e. through algorithms), but current Brazilian competition legislation is more than enough to tackle and punish this kind of conduct.

More recently, in June 2021, the Brazilian fuel distribution company Ipiranga has consulted with the authority about an information technology system to negotiate prices with its retailers. In the consultation, Ipiranga asked about implementing a pricing system that uses a smart mechanism and algorithms to negotiate maximum retail prices charged by fuel stations that operate under its brand. CADE found the pricing system does not raise competition concerns, as some of the system's features prevent it from producing anticompetitive effects on the market. However, as an innovative policy that applies a new technology in the sector, CADE established that its decision remains legally binding for a period of two years.[19]

Finally, it is worth noting that algorithms can – and should – be used by antitrust authorities, for instance, to monitor the market and to detect unusual behavior and pricing anomalies by scanning for anti-competitive issues and signs of cartel conduct. This work relied on CADE's "Brain Project,"[20] which was created to help detect cartels and gather evidence to allow for a more proactive fight against cartels by applying big data, computer science, and statistical modelling.

[19] See Administrative Proceeding 08700.002055/2021-10.

[20] CADE has developed a project (software) called "Brain Project," namely "Projeto Cérebro." See OECD (2018) for more details. OECD (2018) Investigative power in practice - Contribution from Brazil. OECD Global Forum on Competition 2018. Available at https://one.oecd.org/document/DAF/COMP/GF/WD(2018)21/en/pdf.