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PRICE ALGORITHM & COLLUSION: AN ANALYSIS OF COMPETITION CONCERNS

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ABSTRACT

This research paper examines the problems associated with the use of artificial intelligence in the form of price algorithms by market players, as an instrument to limit competition in the market.

An algorithm in essence is a precise procedure which enables a digital system to solve problems. Similarly, a price fixing algorithm is an algorithm designed with the goal to analyse and collate a pool of data to determine the price of a product or service. This allows the seller to entrust the responsibility of pricing the product or service on to the algorithm.

The paper analyses the concept of price algorithms along with the intents of its use, if the use of price algorithms is just one of the trade instruments used for conducting economic activities. However, the world is moving towards *learning algorithms* i.e. algorithms which have tendencies of watching and learning through observation and real time data interpretation. These learning algorithms can lead to non-human concomitant collusive behaviour. The use of price algorithms may lead to anti-competitive behaviour by concluding anti-competitive agreements or coordinating economic activity. Restriction of competition through price algorithms may harm the consumers in the long run and when this happens it will be needed to be controlled by competition authority.

The paper also explores whether it is no longer appropriate to regard algorithms as mere tools of firms, and that the distinct features of machine learning algorithms as super-tools and as probable legal persons may inevitably have caused established concerns for tactic collusion and explicit collusion.

Even though, the concept of price algorithms is not specifically propounded in the Competition Act, 2002 the prohibition of anti-competitive agreements and coordination of economic activities will bring misuse of price algorithms under its ambit. The paper refutes the need to specifically propound the concept of price algorithm in anti-trust law. While drawing from the experiences of various international competition regulators the paper also establishes that when the need arises the 'tech giants' of today should be held accountable for the use of price algorithms to limit the competition in the market.

Keywords: learning algorithm, algorithmic collusion, dynamic pricing, tacit collusion, automatic pricing, artificial intelligence, predictive analysis, disruptive innovation, digital eye.

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I. Introduction

The use of price algorithm is no more a foreign concept in today's world as far as the modern business operations are concerned. With advancement of technology, use of price algorithm as a tool has drastically changed the competitive landscape of industries. Many big and small companies are using price algorithm as a tool for their business operations as well as in process of commercial and strategic decision making of entire industries. Even though it is hard to compute the exact number of companies using price algorithm in business operations, it can be safely said that a substantial number of companies are using algorithms with a view to improve their pricing mechanism, predict market trends, provide targeted advertising and customize their services, etc. An *algorithm* in essence is a precise procedure which enables a digital system to solve problems. The use of algorithms is just another trade tool in the arsenal of conducting economic activities, a tool which has remarkable efficiencies which have benefited both the companies as well as the consumers in the terms of modern, improved and tailor made services.

A *price fixing algorithm*, commonly known as price algorithm is an algorithm designed with the goal to analyse and collate a pool of data to determine the price of a product or service. This allows the seller to entrust the responsibility of pricing the product or service on to the algorithm. Usage of such algorithms in itself is of no huge concern but is rather just an automation process. However, the world is moving towards *learning algorithms* i.e. algorithms which have tendencies of watching and learning through observation and real time data interpretation.

The use of these price setting algorithms in many industries specifically in online ecommerce platforms and various e-service providing platforms have raised concerns whether smart, self learning, price setting algorithms can facilitate or even cause collusive behaviour in oligopolistic markets. The use of these self learning price algorithms along with free availability of pricing information due to a digitalised economy has given enterprises the technological capacity to gain access to prices of the competitors or potential competitors, which leads to suspicion that by observing behaviour of algorithms used by competitors, self learning algorithms could speedily learn to behave in a manner similar to cartel by coordinating their prices to maximize the joint profits of the firms employing them.

These types of new collusive behaviour would give rise to novel quandaries for competition law specifically in regards to liability, the definition of agreement, the monitoring of algorithms and enforcement in case of algorithmic collusion.

In 2015, more than a third of suppliers on Amazon.com already had automatic pricing, and since then this share has probably increased – with the growth of the price re-evaluation software industry, which provides turnkey pricing systems, even the smallest suppliers can now afford algorithmic pricing[3]. According to a recent report by IBM, 79% of retail and consumer products companies plan on using intelligent automation for customer intelligence by 2021[4].

One of the first occasions when the use of learning pricing algorithms caused market discrepancies was in the year of 2011, when Michael Eisen, a biologist at the University of California in Berkeley observed that a classic book by the author Peter Lawrence titled 'Making of a Fly' was selling on Amazon for $ 1.7 million. At that time the book was out of print and only two sellers owned copies that they were offering for retail, though even this supply shortage could not explain the gigantic retail price. The

[3] Milio Calvano et al., Intelligence, Algorithmic Pricing and Collusion, SSRN, 6 January 2019 (Apr. 16, 2020) available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3304991.
[4]IBM Institute for Business Value in association with NRF Retail, The coming AI revolution in retail and consumer products. Report available at https://www.ibm.com/downloads/cas/NDE0G4LA

professor continued to track the book's price till it reached the price of $23 million for a single copy. Michael Eisen observed that every day one of the two sellers of the book would set their price at 0.9983 times the price of the other. Towards the end of that day the second seller would increase the price of the book to exactly 1.270589 times the price of the first seller. The only reasonable explanation that would explain this occurrence was that only the first seller actually had the available copy of the book. In order to maximize profits, this seller set the price minimally below the market. The second seller who did not have a copy of the book had to list a price that included the cost of purchasing the book from the first seller along with a small mark-up. The major issue in this equation was that both the sellers had entrusted the pricing of the book to respective algorithms. Thus every day the algorithms reacted to one-another colluding in a peculiar counterproductive manner until the book reached the gigantic retail price[5].

With the onset of complex algorithms, artificial intelligence and access to internet the expectation is that of an easier and simpler life where we get everything delivered to our doorstep within a matter of hours rather than days. These technologies have without a doubt been advantageous to us in many scenarios including the arrival of *price comparison websites (PCWs)* which give consumers a fighting chance against pricing algorithms leading to low pricing, wider choices of goods and services, better quality, faster delivery and even a better competitive environment enabling a dynamic market and innovation. However, this promise of better competition is very fragile and can be very easily shattered by complex algorithms colluding in a manner that is difficult to understand and analyse leading to higher prices, limits options available at the consumer's discretion while shopping online along with promoting poor quality and a decreased free online environment with less scope for innovation.

II. Methodology

A doctrinal research methodology has been adopted by the researchers for arriving at the abovementioned research analysis and objective. The data comes from secondary sources such as industry reports, various judgements by international courts and the Competition Commission of India. Along with this research refers to numerous articles, research papers and books on the said issues.

III. Application and Effect of Algorithms

The importance of algorithms has grown directly proportional to their adoption by the businesses in an economy. The concept of algorithmic businesses was introduced by Stucke and Ezrachi in 2016 to explain the uses of algorithms in businesses, these uses can be majorly categorised into predictive analytics and business process optimisation[6].

- Predictive Analytics- It is a process of measuring the probability of future outcomes based on the analysis of historical data through an algorithm designed specifically for the analysis of the particular dataset. The dataset maybe historical or based in real time, thus predictive algorithms can be used to predict price change, estimate demand, anticipate consumer behaviour and consumer preferences along with envisage risks and shocks that may affect the market environment. As witnessed by the application of these algorithms by certain big-tech companies, all this information

[5] Michael Eisen, UC Berkley & Howard Hughes Medical Institute. Blog post dated 22 April, 2011, available at http://www.michaeleisen.org/blog/?p=358
[6] Ariel Ezrachi and Maurice Stucke, Virtual Competition: The Promise and Perils of the Algorithm-Driven Economy, Harvard University Press 14 November, 2016.

has proven itself to be exceedingly valuable and enables enhanced decision making leading to better planning, business strategies, customised services and innovation.

- Business Process Optimisation- It is a process of implementing algorithms in order to segment consumers, applying optimal pricing, encouraging market response or reducing production or transaction cost thus gaining a competitive advantage over the competitors in an oligopolistic market. An algorithm is able to achieve these business process optimisations through its enormous computable nature which is used to process macro-scale datasets with faster reaction while incurring lower cost than the traditional system of doing the same tasks.

The use of algorithms for predictive analytics and business process optimisation have found multiple feasible and realistic application across many industries such as targeted advertising, recommendation of products, dynamic pricing, supply-chain optimisation, fraud prevention and even in security. A study of the state of artificial intelligence in India was conducted by a Bengaluru based research-tank "AIMResearch"[7].

As per the report the Indian *artificial intelligence* market is valued at $6.4 Billion as of July – August 2020. An algorithm is a set of rules or instructions given to an artificial intelligence program, neural network, or other machine to help it learn on its own. *An algorithm is the backbone of artificial intelligence, this also known as machine learning in the industry*. MNC IT, Technology, and Electronics companies have the highest share of the market at 36.2% in percentage share, and $2314.3million in terms of market value.[8] The domestic IT companies have a 25.4% market share at a value of $1619.3 million. This includes ITES firms such as TCS, Infosys, Wipro, HCL Tech and Tech Mahindra among others[9]

Banking, financial services and insurance (BFSI) and domestic firms in the Telecom, Oil and Gas, Pharma, Private Banks, Automotive sectors and Cross-sector conglomerates such as Reliance, Airtel, ICICI Bank, HDFC Bank, Tata Motors, Tata Communications, Mahindra & Mahindra, Larsen &Toubro, and the Aditya Birla Group have a market share of 7.1% at a market value of 451.9 million[10].

Ecommerce companies have a 4.8% market share and $ 305.1 million market value. The companies who are the major players in this industry are Flipkart and Amazon; they service the ecommerce and retail markets in India through the AI services; Tesco and Walmart, which solely service the AI segments of their International ecommerce divisions; and Travel & Hospitality portals that facilitate tickets and hotel bookings. Ecommerce companies are using algorithms for a variety of functions ranging from product targeting, market segmentation, pricing, digital platforms, quality, merchandise classification, and shipping & logistics. Algorithmic applications are utilized across the entire value chain of ecommerce and Retail[11].

As can be evidenced from the data provided above, the market for artificial intelligence, machine learning or algorithms is no longer in a nascent stage in India, it is a market that is rapidly growing. The large-scale and main stream adoption of Algorithms by businesses along with changing the way in which these businesses operate and interact with is each other is notably affecting the growth of the market and steering it towards rapid digitalisation. The wider the acceptance of these technologies becomes, the more intense is the domino effect in the industry promoting a wider use of algorithms. This is supported by Stucke and Ezrachi; they state that as companies use algorithms to become more effective and efficient, other companies are influenced and pressurised to digitalise their operations and to develop similar algorithms themselves. Consequently, as more companies rely on these systems, data scientists and computer scientists are

[7] Analytics India Magazine Private Limited, Report on State of Artificial Intelligence in India, September 2020. Available at https://aimresearch.ai/market-and-industry
[8] ibid Page 11
[9] ibid Page 12
[10] ibid Page 13
[11] ibid Page 15

motivated to develop more contemporary advanced programming principle and technologies. These in turn give companies inducement to transpire novel business applications for algorithms[12].

Even governments agencies around the world have been motivated to find applications of algorithms. Data-driven applications have suggested and occasionally even applied to detect patterns of criminal behaviour for example a machine learning algorithm called, "Series Finder" which uses historical criminal data to detect housebreak patterns and compute a methodology[13]. This particular algorithm has proven itself to be a powerful tool in the arsenal of the police to assist them in detection of series of crimes and in identifying likely suspects. *Algorithms have also been suggested for detection of collusion, automation of the screening methods and even investigation cartels.* A few competition agencies have already reported to the OECD of having used algorithms as screens to detect bid rigging cases[14], the algorithm detects bidding anomalies and suspicious bidding pattern across extensive datasets of public tenders bidding data provided. A thriving example of this is Korea Fair Trade Commission (KFTC) who has developed and successfully implemented the Korean bid-rigging indicator analysis system (BRIAS) which has on multiple occasions succeeded in detecting bid rigging conspiracies by implementing the screening process[15] as explained above.

Data oriented marketplaces have been equated with notable efficiencies on the demand as well as the supply side; algorithms have followed the same rule. From the *supply side*, algorithms have helped in increasing transparency, enhancing existing products and services, roping in disruptive innovation, reducing the cost of production, enhancing resource utilisation along with compendium of business processes. Supply side efficiencies enable companies to reduce their cost which is reflected in lower prices to consumers. Deep learning algorithms allow companies to optimise their commercial strategies, receive instant feedbacks leading to an expeditious progress into self-learning algorithms to help with most fields of business operations.

Many supply side efficiencies of algorithms can be attributed to the increasing use of dynamic pricing via pricing algorithms which enable suppliers and consumers alike to act on fast changing pricing, pricing algorithms enable constant adjustment and updating of individual prices on the basis of a set of defined factors such as anticipated demand or pricing set by competitor supplier. Pricing algorithms improve through learning in the process of trial and error, pattern finding, as the data set increases by collection of more and more data by companies the algorithms get multi-fold opportunities to experiment and create personalised consumption suggestions and the pricing becomes increasingly dynamic, personalised and differentiated. While this is a plus from supplier's perspective, pricing algorithms have been criticised for facilitating perfect price discrimination by allowing businesses and companies to price consumer on the basis of their personal data such as their location, search history, previous pattern of purchasing etc. perfect price discrimination enables companies to gauge the willingness of a consumer to pay and offer lower prices to consumers with lower willingness to pay, this may result in undesirable elements of discrimination such as on the basis of gender or race. Dynamic pricing via pricing algorithms is also criticised for having disrupted the market balance by non-algorithmic sellers to compete for the attention of sellers under endless and perpetual price fluctuation, without such sellers also shifting to algorithms to level the playing field.

From the demand side, algorithms have helped to assist consumers in their purchasing decisions, organise information and making it more accessible, thus creating substantial demand side efficiencies. The notion of "Algorithmic Consumer" was conceptualised in 2017 by Michal S. Gal & Niva Elkin-Koren to explain the shift in the decision making process f the consumers. In the current data driven economy many consumers have outsourced their purchasing decision to algorithms via algorithms that can used to compare prices and quality commonly known as price comparison websites. These algorithms also help consumers overcome

[12] Ezrachi, A. (2015), "The Competitive Effects of Parity Clauses on Online Commerce", Oxford Legal Studies Research Paper No. 55/2015, https://ssrn.com/abstract=2672541.
[13] Wang, T., Rudin, C., Wagner, D., & Sevieri, R. (2013). Detecting Patterns of Crime with Series Finder. AAAI.
[14] Report to the OECD Council on the implementation of the Recommendation of the Council on Fighting Bid Rigging in Public Procurement, 17 July, 2012.
[15] Korea's submission to the Roundtable on Ex officio Cartel Investigations (2013), OECD. Available at www.oecd.org/dad/competetion/exoficio-cartel-investigation-2013.pdf

biases, reduce search and transaction costs, predict market trend along with making faster and more rational decisions. As per Gal & Niva Elkin-Koren, by the use of these comparison websites a consumer may be able to avoid consumer biases that may have resulted in non-optimal decision as well as avoid manipulative marketing strategies and individualistic price discrimination[16]. Moreover by enabling consumers to compare a huge number of deals or offers algorithms create a possibility of the consumer shifting to another supplier, this creates a competitive pressure on suppliers and increases their incentive to innovate and compete.

IV. Role of Algorithms as Facilitators of Collusion

As pointed out above, automated computer algorithms are powerful business tools that also offer many positive competitive effects. However algorithms may also be used to execute virtually any anti-competitive conduct as is the case with traditional markets, the aspect that raises the most amount of concern globally is whether algorithms have the capability to be applied in a manner that they become facilitators of collusion. The nature of cartel activities in today's world have evolved and it is moving beyond co-agents sitting together to conspire using computers or mobiles. Pricing Algorithms have widened the traditional circumstances of anti-competitive activity, making it even more subtle, elusive and changed it into non-hard-core cartel like formation. Still the objective should not be whether algorithms should be banned rather it should be to gain an understanding of the various scenarios in which pricing algorithms may facilitate a more novel method of price collusion. To evaluate this it is first important to understand the concept of collusion in itself. Collusion is a terminology used to indicate any form of agreement or coordination among competing companies with the aim of increasing profits to a higher than the level existing in competitive market. Therefore, collusion is a joint profit maximisation scheme, put in place to fleece consumers. In order to reach and successfully run a collusion scheme, the colluders must agree on a governing system allowing them to agree on a common policy along with a system to comply and enforce that agreed policy[17]. Economists have generally divide collusion into two forms- explicit and tacit[18].

Explicit Collusion – it is a reference to anti –competitive behaviour occurring through explicit agreements, the agreement maybe in the form of oral or written agreement. This is the form of collusion that is traditionally observed in the market, this is the form wherein the firms interact directly and form a consensus with regards to price as well as output in order to achieve collusion[19].

Tacit Collusion – it is a reference to a form of anti-competitive behaviour that is achieved without the help or need of an explicit agreement, instead competitors are able retain their individuality while attaining collusion by recognising their mutual interdependence. Herein every competitor decides their own independent profit maximisation strategy with the help of a transparent market and market players, enabling the firms to take advantage of their combined market power without forming an explicit agreement[20]. The conduct herein is not covered by standard antitrust behaviour as the issue at the heart of tacit collusion is algorithms achieving a collusive equilibrium tacitly, without the help or need of contact between competitors and without agreeing on any facilitating practice.

[16] Michal S. Gal & Niva Elkin-Koren, Algorithmic Consumer. Harvard Journal of Law & Technology, Volume 30, Number 2 Spring 2017. Available at https://jolt.law.harvard.edu/assets/articlePDFs/v30/30HarvJLTech309.pdf

[17] Common definitions of collusion can be found in OECD (1993), O'Sullivan and Sheffrin (2003) and Green et al. (2013)

[18] See Green et al. (2013), Harrington (2012), Ivaldi et al. (2003), Tirole (2002), Posner (2001) and Turner (1962).

[19] ibid

[20] The role of transparency as a relevant factor for collusion is more extensively discussed in Ezrachi and Stucke (2016), Whish and Bailey (2012), OECD (2012b), OECD (2010), Ivaldi et al. (2003) and Stigler (1964).

The various probable scenarios have been propounded and explained by Ezrachi in his book[21], these scenarios have been widely examined and accepted in global competition law community by academicians and practitioners alike.

- ***The Messenger***

Under this scenario firms form an agreement to use an algorithm that will charge cartel prices even under changing market conditions. Herein even though an algorithm is used as a collusive device no new competitive concern is raised as an explicit agreement between the competitor firms is required here in order to form and sustain a cartel. So here algorithm is essentially just another new technology adopted by cartels, as has been observed with time cartelists have always used any available new technology whether it was introduction of telephones, computer programs, email or messaging applications. With the introduction of every new technology and opening of new ways to facilitate collusion, it becomes slightly more difficult to gather evidence of exchange of information between the cartel members. Use of algorithms is no exception to this rule, it is going to more difficult to detect and understand the exchange of information taking place between firms and expert help will be required by competition authorities[22]. The United States v. Topkins (2015)[23] case maybe cited as one of the best examples to explain this scenario.

- Before the United States v. Topkins (2015) was prosecuted apprehension that big databases, algorithmic processing and algorithmic price setting can be used to negatively impact competition in a certain market remained in the realms of legal and economic theory. In this case the defendant and his co-conspirators used specific pricing algorithms to implement their price fixing agreements; this was done with the goal of coordinating changes in each of their prices with the help of a computer code specifically designed to achieve this specific goal. This case for the very first time raised the question of how competition law should with algorithmic processing and automated pricing. The information charged Topkins with a criminal violation of Section 1 of the Sherman Act for entering into a price fixing conspiracy. The conspirators were alleged to have agreed to sell via Amazon platform, wall posters and other similar wall decor, for third party seller at a coordinated pricing. This coordinated pricing was arrived at with the use of the same software embedded algorithm, which posed a unique challenge as an algorithm does not need to create an internal paper or email trail of evidence which may act as evidence of anti-competitive act. Since this case did not proceed to trial and was pleaded out, not much information is available in the public domain. However, the limited information available state that the conspirators used commercially available algorithm pricing software which operated by collecting the pricing information of competitors of a specific product sold on Amazon and applying pricing rules set by the seller to arrive at the optimum collusive price which was then agreed upon by the colluding parties and implemented to the product of the colluders. Topkins was accused of writing the computer code that instructed the algorithm to set prices of the agreed upon posters in conformity to the agreement between the conspirators.

- ***The Hub and Spoke***

Under this scenario multiple firms use the same algorithm for the same purpose, such as for shifting pricing decision to a common third party which provides services of algorithmic pricing, companies like *Boomerang, Feedvisor, Pricing Pro* and others. In this scenario the third party acts as the Hub and there is an exchange of sensitive information through the Spokes, i.e. the competitor multiple firms that choose to

[21] Ezrachi, A., Stucke, M. (2015)
[22] Supra Note 14, Gal (2018)
[23] Plea Agreement, United States v. David Topkins [30 April 2015] <https:// www.justice.gov/atr/case-document/file/628891/download>; Information, United States v. David Topkins [6 April 2015] <https://www.justice.gov/atr/case-document/file/513586/download>

outsource their pricing decision to the hub. Thus the hub facilitates cartelistic behaviour among competitors, this arises concern because these arrangements remove uncertainty with respect to competitor's behaviour. A coordinated equilibrium could be achieved if the central price algorithm sets prices with the objective of maximizing joint profits. Although it is argued that if competitor firms use proprietary algorithms and these algorithms are competing with each other, the algorithms produced will be generally different, observing different trends and learning in an exclusive manner. Also it must be remembered that most algorithms contain variable elements for exploring and thus the convergence of such algorithms to a stable set of profit maximizing profits on their own is not certain. It may be said that for a hub-spoke cartel scenario to occur a little communication and an agreement is necessary between the parties, which in essence leads to back to the same age old cornerstones of cartel formation- intent, communication and agreement. This also means that the existing law has a sufficiently wide ambient to cover a Hub-Spoke Cartel. A sentiment that has been very appropriately worded by the Federal Trade Commissioner Maureen Ohlhausen " if the word algorithm can be replaced by the phrase a guy named bob then algorithms can be treated exactly as agents in a traditional hub-spoke cartel.[24]"

The Competition Commission of India (CCI) on 6th November 2018, in Samir Agarwal v. Ola & Uber adjudicated for the first time on the issue of hub and spoke arrangement and held that an existence of collusion was necessary for hub and spoke conspiracy. The informant Samir Agarwal was a consumer of the service providers Ola and Uber. He filed a complaint in the Commission on the grounds that the conduct of Uber and Ola violated Section 3 of The Competition Act, 2002. The complainant alleged that due to the use of algorithms by Ola/Uber to determine and set taxi fares, the drivers operational on this platform were precluded from competing with each other on fare. The complaint further argued that the drivers operating on the platforms were independent third party service providers and cannot be termed as employees of Ola/Uber; which would establish that the drivers and Ola/Uber were not a single entity ant the arrangement between them would amount to price fixing wherein Ola/Uber acted as hubs and the drivers as the spokes to collude on prices. The CCI in its order stated that the arrangement in the present case was not that of a hub and spoke arrangement due to the absence of collusion or an agreement to collude between the drivers on Ola and Uber. The Commission found that while the drivers have agreed to determination of taxi fares through the algorithms of Ola or Uber; it did not amount to collusion among the drivers. The reasoning behind the said finding is that a hub and spoke model of cartelisation in the present case would need an agreement between the drivers that the platforms would coordinate the prices among the drivers.
An important point that was made by CCI in its observation on hub and spoke conspiracy is the existence of horizontal agreement, which is an agreement between the drivers to collude on the prices resulting in a loss of the consumer, was necessary for establishing a hub and spoke form of collusion conspiracy. This observation is crucial as a hub and spoke collusion is in essence collusion between the spokes. Therefore, a vertical agreement between the hub and sokes would imply a horizontal collusion wherein several spokes (drivers) would have entered into a vertical agreement with the hub i.e. Ola or Uber. In this case the drivers i.e. the spokes were not in a horizontal conspiracy with each other[25].

- ***Predictable Agent***

Under this scenario each firm individually develops an algorithm to provide prediction of outcomes and reaction in given ways to changing market conditions. Each firm in this scenario is acutely aware of the probable developments by other algorithms being used by competitors[26]. Since algorithms are designed and used in a manner to monitor the prices set by other algorithms and to follow these ever changing prices they will ultimately lead to interdependence between the firms. Given that these algorithms are capable of

[24] 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, Remarks from the Concurrences Antitrust in the Financial Sector Conference New York, NY, available at https://www.ftc.gov/system/files/documents/public_statements/1220893/ohlhausen_-_concurrences_5-23-17.pdf.
[25] Samir Agarwal and ANI Technologies Pvt. Ltd. & Ors., Case No. 37 of 2018, Competition Commission of India
[26] Ezrachi, A., Stucke, M. (2015). Artificial Intelligence and Collusion: When Computers Inhibit Competition, *University of Illinois Law Review*, 2017(5): 1775–1809.

reacting rapidly to these changes such pricing behaviour will lead to reduced competitive pressure in the market and to increased likelihood of collusive behaviour. A parallel can be drawn between these price algorithms and traditional price guarantees being used by cartels, and similarly as in the case of price guarantees these price algorithms will tend to incentivize all other firms present in the market to use similar algorithms which could give rise to industry wide algorithm based collusive behaviour[27]. A good example of this scenario is the curious case of two sellers on Amazon involving the attempted sale of the genetics book "The making of a Fly" as discussed in the introduction to this paper.

- ***Autonomous Machine or Digital Eye***

In the autonomous machine scenario algorithms are not mere tools used by homo-sapiens to form a cartel rather the algorithms are autonomous agents created by firms to attain a certain goal, for example profit maximization. As per Ezrachi and Struke "The machines, through self learning and experiment will determine the means to independently optimize profits."[28] They have also stipulated that due to the internet the competing firms would be perfectly informed about all aspects whether in relation to production or logistics or consumers or sale or deliveries. This would substantially increase the monitoring capabilities of the algorithms leading to tacit collusion occurring at a rapid speed which could lead to cartel like development across entire industry. In the words of Ezrachi "With industry-wide use of algorithms, we may experience conscious parallelism in markets with many more players, where previously collusion would have been unstable.[29]"

The major concern that this paper has tried to highlight as yet is that the algorithms have a potential to expand the grey area between explicit collusion and tacit collusion which will allow firms to sustain profits over and above the competitive market level without ever having entered into an explicit agreement for example, an algorithm may utilised in a manner as to create a new mechanism that facilitates the implementation of common policy as well as monitor the behaviour of other firms without ever involving any human interaction, thus the algorithm will replace explicit collusion with tacit co-ordination. The Competition Act, 2002 gives the term "agreement" a very broad definition which has ensured the widest possible reach of the law, agreement is defined as "any arrangement or understanding or action in concert-whether or not it is writing or whether or not it is intended to be enforceable by legal proceeding.[30]" On a plain reading of section 3 of the act, it will be very apparent that by the nature in which competition law are structured it is a prerequisite to identify an agreement between competitors in order to call it collusive behaviour. The question that arises is whether the more subtle forms of communications will fall in the scope and definition of agreement, a question that will have to soon be settled by competition law enforcement agencies around the world. Without the presence of actual communication or of explicit coordination, with the mere presence of parallel conduct through algorithms which may be justified as nature of oligopolistic market and rational behaviour, the application of the provision of agreement is not straightforward. There is an increasing concern between scholars and practitioners alike that in order to address algorithmic collusion, a new definition of what is an agreement for anti-trust activities maybe required, on the inverse side there is a debate as to whether the classic oligopoly behaviour should be allowed to be considered or prosecuted as an unlawful agreement[31].

[27] Ezrachi, A., Stucke, M. (2016a) How Pricing Bots Could Form Cartels and Make Things More Expensive, *Harvard Business Review*, October 2016. Available at https://hbr.org/2016/10/how-pricing-bots-could-form-cartels-and-makethings-more-expensive?autocomplete=true.
[28] Supra note 4
[29] Ezrachi, A., Stucke, M. (2016b). *Virtual Competition*, Harvard, MA: Harvard University Press.
[30] The Competition Act, 2002-Section 2 (b)
[31] Hay, G. (2013), "Anti-competitive Agreements: The Meaning of 'Agreement'", Cornell Law Faculty Working Paper No. 105, http://scholarship.law.cornell.edu/clsops_papers/105.

V. Plausible Alternative Approaches

Before jumping to the conclusion that radical approaches, possibly of a legislative nature or revisiting the notion of agreement or revaluating legal approach to tackle tacit collusion as well as for deciding the scope of liability for artificial intelligence, a serious effort should be made to apply the existing, traditional approaches to the issues at hand, as in practice the competition law is just beginning to come face to face with algorithms and the distortions created by them in the market. A few of such traditional approaches that have high probability of being effective against collusive algorithms would be ex ante measures like market studies utilisation, merger control enforcement or a regulatory remedial measures.

Market investigation and market study in scenarios may be conducted where it is observed that there is no indication of any co-ordination among the market players but there are clear indications that a sectoral market is not functioning well, the study should be focused on understanding why the market is failing and towards identifying possible solutions for market self correction, enforced correction as well as possible policy solutions. The Indian Competition Commission of India has already conducted two such market studies; the first one in E-commerce of India in August 2019[32] and the second one in telecom sector of India in January 2021[33]. An example of market studies being conducted with regards to identifying possible issues that may arise from use of algorithmic pricing is the Inquiry conducted by European Commission (EC) on Ecommerce Sector in 2017. In the final report the EC as a part of its finding stated that in their surveys it was found that about two third of the retailer track the online prices of their competitors with the help of algorithmic pricing softwares that enable the retailers to modify their own prices in comparison to their competitors' prices in real time. These pricing softwares detect movement from recommended retail prices in just a few seconds therefore enabling manufacturers to monitor and influence retail price by influencing retailer's price setting. The EC warned that the easy availability of real time pricing information may lead to a collusion of prices that is automised in nature which could become a competition concern depending upon the market conditions and the penetration of such softwares in the market.[34] This inquiry led to the discovery of real world harm that these price algorithms are causing, EC in the same report concluded that:

"As a reaction to increased price transparency and price competition, manufacturers have sought greater control over distribution networks, with a view to better controlling price and quality. This translates into an increased presence of manufacturers at the retail level and increased recourse to agreements or concerted practices between manufacturers and retailers ('vertical restraints'), affecting competition among retailers selling the same brand ('intra-brand competition')"[35]

Ezrachi and Stuke (2017) suggest that if agencies seek to examine whether algorithms commonly result in colluded effect and if such an effect is present in the market then attempts should be made to identify the circumstances and sectors wherein such algorithmic collusion is most likely to occur. Such market studies by competition enforcement agencies will help with understanding the new dynamics in algorithm markets and the scale of any competitive issues which may further lead to recommendations for the governmental intervention or for key stakeholders to execute behavioural change or initiate advocacy efforts to the key stakeholders and recommendations to the small business community dealing with the effect of market distortion due to use of price algorithms.

Another plausible ex ante measures towards controlling collusion due algorithms is by focusing analysis on the impact of the merger transactions on market competition and characteristics like price transparency, speed of interaction and other factors that are most effected by algorithms. This measure would mean utilising the *merger control system* with focused intent of preventing tacit collusion in markets with

[32] Competition Commission of India, Market Study on E-Commerce in India, 2019. Available at-http://www.cci.gov.in/sites/default/files/whats_newdocument/Market-study-on-e-Commerce-in-India.pdf
[33] Competition Commission of India, Market Study on Telecom Sector in India, 2020. Available at-http://www.cci.gov.in/sites/default/files/whats_newdocument/Market-Study-on-the-Telecom-Sector-In-India.pdf
[34] Report From The Commission To The Council And The European Parliament, Final report on the E-commerce Sector Inquiry. Brussels, 10.5.2017 COM(2017) 229 final. Page 5. Available at https://ec.europa.eu/commission/presscorner/detail/en/IP_17_1261
[35] ibid

algorithmic activities. An example of this maybe seen in the recent CCI's merger control decision in the radio taxi sector- Hyundai Motor Company and Kia Motor Corporation's acquisition of shareholding in the online taxi operator Ola to the tune of $300 million[36]. To assuage the completion law concerns of CCI, the parties voluntarily offered commitments with regards to the algorithm of Ola. The commitment requires the algorithm of Ola to not prefer drivers solely on the basis of the brand of the passenger vehicle driven by the driver i.e. by the manufacture and make of the vehicle of the driver.

One of the highly internationally discussed ex ante measures towards controlling collusion is employing the *behavioural approach* such as "notice and take down" process wherein the online host in response to court orders post a notice and remove the content, this is a practice that is generally followed by content platforms to enforce intellectual property laws. The aim of the behavioural approach is to stop oligopolists from establishing mechanisms that are harmful to the competitive nature of a market and facilitates collusions.

VI. Plausible Regulatory Intervention

At the current point of time no competition regulatory body has adopted any regulations to prevent machine learning algorithms from achieving tacit collusion as there is a possibility of causing harm to the competitive process in other forms. In the various discussions held on algorithmic collusion in the international competition sphere no regulatory solutions have been proposed so far. It is also important to consider that there are currently no competition investigations or cases and therefore no justification currently exists for the creation of regulations to prevent algorithmic collusion. No regulations should be created to prevent the negative impact of conducts that have not yet been observed.
However, since detecting machine learning algorithm caused collusion will be extremely hard and taking into consideration the incredible speed at which the digital markets have evolved in the past ten years; many competition regulatory bodies have considered it necessary to initiate a discussion on the types of regulations that maybe considered in the future when this unique form of collusion forms a part of the ecommerce market reality. The potential forms of regulatory interventions that various competition regulatory bodies have discussed and may be tempted to consider are discussed herein.

- Price Regulation- When algorithms start leading to anti-competitive prices in the digital markets without the help of traditional collusion factors such as intention, communication etc; the knee jerk reaction of many competition regimes may be to introduce maximum price regulations. However, such maximum price regulations have generally been recognised to pose consequential barriers to competition as well as reduce incentives to innovate and should therefore be avoided where possible and be substituted with alternate policies[37].

- Rules on Algorithm Design- Competition regulatory agencies could with time may consider the introduction of rules that restrict the very process of designing algorithms. According to Vestager (2017): "What businesses can – and must – do is to ensure antitrust compliance by design. That means pricing algorithms need to be built in a way that doesn't allow them to collude. Like a more honourable version of the computer HAL in the film 2001, they need to respond to an offer of collusion by saying "I'm sorry, I'm afraid I can't do that." [38] The though process is that if the aim is to inhibit companies from independently arriving at coordinated anti-competitive prices, regulation may prevent algorithms from reacting on particular market variables that are found to be necessary to sustain tacit collusion. The reason for the development of this regulatory intervention is best described by the word used by the U.K. enforcer David Currie while talking about machine learning algorithms- "How far can the concept of human agency be

[36] Competition Commission of India, Notice under Section 6(2) of the Competition Act, 2002 filed by Hyundai Motor Company and Kia Motors Corporation; 30th October 2019.
[37] Competition Assessment Toolkit (OECD, 2016c); Paragraph B1
[38] https://www.pinsentmasons.com/out-law/news/concern-over-collusion-through-algorithms-raised-by-eu-competition-regulator

stretched to cover these sorts of issues?"[39] Therefore, protections must be built in the software itself, assigning the responsibility of educating the machine learning algorithms to avoid or disregard collusion, on the computer engineers. This solution will lead to constraining the ability of firms to experiment and develop innovative algorithms, which might lead to a slowdown in the growth of the digital markets. Another flip side to this regulatory intervention is that regulating algorithmic design will present an additional burden on competition regulatory agencies of monitoring whether companies are abiding by the rules of algorithm designing.

- Policies Deterring Tactic Collusion- Another plausible step towards regulation is development of policies that will lead to a change in the structural composition of the digital market that is most likely to facilitate collusion. An example of this maybe reducing the transparency of discounts offered by various digital shopping platforms by the enhanced use of discount codes, another example would be a policy to impose lags on price adjustment and frequency of digital market interactions. This solution will also lead to restricting the amount of information available to the customer and is likely to create acute restriction to completion[40]. This can be better explained by referring to the above example of enforcing a lag and explaining its unintended consequence; if fast price adjustment is restricted it will lead to restriction of efficiently matching demand and supply.

On the basis of above it maybe concluded that introduction of regulatory intervention will have the far-reaching consequence of harming the competitive process down the line. Therefore, if a regulatory body endeavours to design regulations to make the digital market less susceptible to collusion, a very conservative approach should be adopted as these rules have the potential to cause unpredictable implications that may sooner or later hamper the good functioning of the digital markets.

VII. Conclusion

In conclusion, the nature of cartel activity today is on the cusp of evolution, wherein instead of finding people using computers to collude, it will be machine learning algorithms or people using pricing algorithms specifically designed to achieve collusion. This will pose unique challenges for enforcement of competition law as not only does an algorithm not need to create an internal paper/ e-mail trail for communication which would have evidenced the cartel formation but it is also harder to assign liability of the anti-trust act committed by the algorithm. Moreover, from the perspective of economic theory an algorithm's increased ability to gather and process humongous amount of data will decrease the probability of break down in collusive pricing which is usually caused by a lapse or error in assessing market conditions; it will also faster detection and prediction of defectors from an explicit cartel and therefore make it more stable[41]. Keeping this in mind the competition law regulatory authorities will also have to adapt as they will no longer be able to rely on the inevitable breakdown of a traditional cartel or defectors utilising the leniency programmes offered by various competition regulatory bodies in exchange of cooperation and information on the cartel.

It is vital to remember that the promise of better competition is very fragile and can be very easily shattered by complex algorithms colluding in a manner that is difficult to understand and analyse leading to higher prices, limits options available at the consumer's discretion while shopping online along with promoting poor quality and a decreased free online environment with less scope for innovation. Competition authorities across the globe will have to investigate these pricing algorithms pro-actively and send a clear

[39] https://www.politico.eu/article/trust-busting-in-the-age-of-ai/
[40] paragraph D of the checklist of the Competition Assessment Toolkit (OECD, 2016c)
[41] See Salil K. Mehra, 'De-Humanizing Antitrust' (Columbia Law School Blue Sky Blog, 16 October 2014) <http://clsbluesky.law.columbia.edu/2014/10/16/de-humanizing-antitrust-the-rise-of-the-machines-and-the-regulationof-competition/>

signal to the big data companies and others that companies must ensure that do not deploy algorithms in a fashion that adversely effects the competition of a market.

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