ALGORITHMS & COMPETITION LAW

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I. INTRODUCTION

What do algorithms have to do with antitrust? Nothing intrinsically, but algorithms feed of data and data is an issue for antitrust enforcers. The ability of a firm to collect extremely large amounts of data and process them through sophisticated algorithms to reveal patterns, trends and associations (collectively known as "big data") adds a new dimension to market power, which ought to be of interests to competition authorities. Having a data advantage can lead to great innovations, but it can also create huge concentrations in certain markets. Data can affect entry conditions by making it more or less difficult for a firm to enter or compete, in particular for firms needing data as an input in order to compete in a specific market. There is a belief that simple algorithms with lots of data outperform sophisticated algorithms with little data partly because of the opportunity for algorithms to learn through trial and error.[2] According to Peter Norvig, Google's director of research, Google "…don't have better algorithms than everyone else; we just have more data."[3] While big data raises many legal, moral and ethical issues, such as cyber security and the undertakings' accountability for the actions of their algorithms,[4] this article focuses on the implications of data and algorithms for competition policy.

II. COMPETITION LAW IN DIGITAL MARKETS

A. Algorithm Input

An algorithm is only as good as the data input. The volume of data is of particular significance in relation to the operation of algorithms. With data input, algorithms will be able to predict trends and behaviors or assess the likelihood for certain events to occur from the deduction or inference from new information.[5] Deep learning (the design and development of smart, self-learning algorithms) software and algorithms crunch large datasets, thereby "learning" to recognize patterns in digital representations of sounds, images, and other data.[6] This allow algorithms to carry out a myriad of functions relating to inter alia pricing decisions, matchmaking, planning, logistics, online communications and ecommerce. As a result of deep learning, algorithms can understand and translate languages, identify images, write news articles and analyze medical data. Advancements in data science have led to the ability to learn fast and deep from big data with the aid of algorithms that access and analyze vast amounts of information quickly. The analysis of data, performed through algorithms and advanced data processing techniques (i.e. big analytics), becomes more valuable to the extent that it allows for specific patterns to be found and new correlations to be made between several datasets coming from a combination of different data sources.[7]

2 Ariel Ezrachi & Maurice Stucke, Virtual Competition 16 (2016).

3 Cited by Tim O'Reilly "'Whole Web' Is the OS of the Future," (2010) CNET. https://www.cnet.com/news/tim-oreilly-whole-web-is-the-os-of-the-future/.

4 Maurice Stucke & Allen Grunes, Big Data and Competition Policy 1 (2016).

5 Primavera De Filippi, *Big Data, Big Responsibilities* 3 Internet Policy Review 2 (2014).

6 Robert D. Hof, *Is Artificial Intelligence Finally Coming into Its Own?* MIT Technology Review (2014) https://www.technologyreview.com/s/513696/deep-learning/.

7 Primavera De Filippi, *supra* note 5.

B. Consumer Benefits

This algorithmic development has brought about important benefits for consumers in digital markets. First of all, the collection and processing of data has conferred upon digital firms the ability to identify new trends and develop new products and services of particular relevance for users.[8] Secondly, detailed knowledge on consumers' preferences and behavior can be derived from data mining, and this knowledge allows digital firms to better target ads and products, supply personalized services, and increase consumer retention and loyalty. Targeted advertising in turn can increase sales and revenues for marketers and merchants,[9] reduce advertisement investment that is wasted when addressed to consumers uninterested in the advertised product,[10] and reduce consumer annoyance.[11] Thirdly, based on observed behavior, big data enables the redesign and/or improvement of services, business processes, strategies and efficiency in general (for example, big data can be used to speed up transactions and reduce the likelihood of product returns).[12] Lastly, big data has contributed to a great extent to the emergence of business models under which digital services and content are offered to consumers at zero prices.[13]

C. Antitrust Issues

1. Leverage

User data collected in one market (for example, in the search engine market or social network market) can be used to improve quality in another market (for example, in the online display advertising market). Where the same data can be used in two or more markets, an incumbent can benefit from a "domino effect": it can leverage its dominant position in market A, which is derived from its data-advantage, to cause a connected market B to tip, even where market B is already served by traditional incumbent firms.[14] There are numerous examples of this trend. For instance, as a result of its dominance in the market for online search Google was able to identify data that was useful for the digital maps market. Google Maps soon became the market leader after Google expanded onto this segment, quickly displacing the theretofore-market leader MapQuest.[15] Google repeated this move in many "vertical" segments, such as travel, and shopping, having recently fined by the European Commission for abusing its dominant position with its own comparison shopping service.[16]

Additionally, data-linkage has enabled Google to extend its dominance in online search onto numerous related online segments, such as mobile operating system (Android), web browser (Chrome), email service (Gmail), video streaming site (YouTube), mapping service (Google Maps), website analytics tool (Google Analytics), cloud platform service (Google Apps), display advertising technology (DoubleClick and AdMob). A one firm scenario dominating numerous online markets is inconsistent with a competition policy that seeks to keep markets open and ensure entry and exit dynamism. Worse still, data that is collected online can be used as an input to gain dominance in other "offline" markets. For instance, mapping data is of the essence for the development of autonomous cars.[17] Google already has mapping technology (Google Maps), in addition to the crowd-sourcing app Waze, which provides real-time traffic, accident, and police information. As a result of increased use of these services Google is able to improve its mapping technology, thereby gaining the upper hand in the race for the development of self-driving cars. Indeed, this

8 Monopolkommission, *Special Report 68: Competition Policy: The Challenge of Digital Markets* (2015) 30 http://www.monopolkommission.de/index.php/en/reports/special-reports/284-special-report-68.

9 CMA report "The Commercial Use of Consumer Data – Report on the CMA's Call for Information," 50 (2015).

10 Robert C. Blattberg & John Deighton, *Interactive Marketing: Exploiting the Age of Addressability* 33 Sloan management review 5, 8–11 (1991).

11 At least as compared with non-targeted advertising, since targeted advertising can be perceived by consumers as less vexatious or even as informative. Monopolkommission, *supra* note 8, 31.

12 CMA report, *supra* note 9, 93.

13 Under this business model firms ("platforms") offer consumers a free product or service on one side (the "user side") and earn their income on the other side (the "paying side") from selling to advertisers the ability to access these consumers with targeted behavioral ads.

14 Jens Prufer & Christoph Schottmüller, "Competing with Big Data," 3 (2017) Tilburg Law School Research Paper No. 06/2017 2 https://papers.ssrn.com/abstract=2918726.

15 See Consumer Watchdog.org, "Traffic Report: How Google Is Squeeinzg Out Competitors and Muscling into New Markets," (2010) A study by Inside Google.

16 European Commission, 'European Commission - PRESS RELEASES - Press Release - Antitrust: Commission Fines Google €2.42 Billion for Abusing Dominance as Search Engine by Giving Illegal Advantage to Own Comparison Shopping Service' (2017) http://europa.eu/rapid/press-release_IP-17-1784_en.htm.

17 'We will only be able to have self-driving vehicles on the highway in 2020 with highly accurate maps.' NTT Data, 'Automotive 4.0 - Sensing the Road Ahead for Tier 1 Suppliers' (2015) 11 https://emea.nttdata.com/uploads/tx_datamintsnodes/Whitepaper_Automotive_Tier1_final_single.pdf.

may be one of the reasons why Google's self-driving technology division (Waymo) "is widely considered to be the front-runner among companies developing autonomous technology."[18]

As a consequence of the "domino effect," insurmountable barriers to entry are likely to arise. Any entrant that wishes to compete in an online platform market (for example, in a search engine, social network or App store market) must build a platform capable of providing services having the ability to compete with those of the incumbent. Setting up a platform demands high investments in R&D. For example, FTC Staff found that search and search advertising platforms "require enormous investments in the technology and infrastructure required to crawl and categorize the entire Internet," noting that Microsoft invested in 2010 more than USD 4.5 billion to develop its algorithms and build the physical capacity necessary to operate Bing.[19] In addition, the collection, storage, processing and analysis of user data involves substantial fixed costs and low or negligible marginal costs,[20] which means that established firms have cost advantages over entrants in this regard. But setting up the platform is not enough. To launch an effective challenge (and therefore to have access to the data necessary to compete), competitors must be able to attract a sufficiently large user base. To this effect, they must basically develop an infrastructure capable of matching that of the incumbent. For example, any company intending to launch a serious challenge against Google in the search market cannot just rely on search query data. Rather, it must find the way to gather data from other sources, especially browsing and locational data, in order to give rise to economies of scope and thereby enhance the quality of its search results. Not even Microsoft with its deep pockets has been able to achieve that.

Something remarkably similar has occurred in the ecommerce segment. By embarking upon a strategy of sustaining losses and investing aggressively at the expense of profits, and integrating across multiple business lines aided by the data it has been able to collect and process,[21] Amazon was able to create an infrastructure that cemented its leading position. In addition to being a retailer, Amazon is an advertiser, delivery and logistics network, a payment service, a credit lender, an auction house, a book publisher, a producer of TV shows and films, a hardware manufacturer and vendor and a leading provider of cloud services. Important synergies, derived from data-driven economies of scale and scope, enable Amazon to optimize its operations in all of the business segments above, synergies, which competitors in individual segments cannot possibly match. In order to compete effectively against Amazon, taken as a whole, any entrant would have to invest heavily on each of such segments. In addition, Amazon avails itself of data to make strategic business decisions. For example, Amazon has used sales data gathered from Amazon Marketplace to sell products that have proven successful and popular. It has been reported that Amazon has begun selling 25% of the top items first sold by Marketplace vendors in the women's clothing retail segment.[22] In this way, Amazon avoids the initial costs and uncertainties surrounding the introduction of new products and sells products, which are a proven success, to the direct detriment of those vendors who assumed the initial risk. Accordingly, Amazon uses the advantages arising from vertical integration, in particular, the very fact that some of its customers are also its competitors. Relatedly, it has been reported that Amazon has had recourse to insights derived from its cloud computing service to make investment decisions.[23] Amazon can tell which cloud customers need more server capacity, thereby obtaining clues as to the business and technologies that are gaining tractions, clues that venture capital firms do not have.[24] Aided by data, Amazon can safely and successfully expand onto many segments, thereby consolidating its leading position and financial strength.

18 Annie Palmer, 'Looks Like Apple Just Killed the ICar' (*TheStreet*, 2017) https://www.thestreet.com/story/14281269/1/apple-switches-gears-on-its-self-driving-car-ambitions.html.

19 FTC Staff, "FTC Staff Report on Google - File No. 111-0163," 76 http://graphics.wsj.com/google-ftc-report/.

20 CMA report, *supra* note 9, 75.

21 For a detailed discussion of anticompetitive concerns relating to Amazon see Lina M Khan, *Amazon's Antitrust Paradox* 126 The Yale Law Journal 564, 746–747 (2016).

22 Spencer Soper, 'Got a Hot-Seller on Amazon? Prepare for e-Tailer to Make One Too - Business News | The Star Online' https://www.thestar.com.my/business/business-news/2016/04/30/got-a-hotseller-on-amazon-prepare-for-etailer-to-make-one-too/.

23 Based on these insights, Amazon has invested in startups Yieldex, Sonian, Engine Yard & Animoto, among others. See "FEATURE-Amazon Finds Startup Investments in the 'Cloud,'" *Reuters* (9 November 2011) https://www.reuters.com/article/amazon-cloud/feature-amazon-finds-startup-investments-in-the-cloud-idUSN1E7A727Q20111109.

24 *Ibid.*

2. Consumer Choice

The presence of the same tech giants across many industries has deleterious effects on consumer choice. Take the example of Android. As Google SVP & General Counsel noted: "…while Android is free for manufacturers to use, it's costly to develop, improve, keep secure, and defend against patent suits. We provide Android for free, and offset our costs through the revenue we generate on our Google apps and services we distribute via Android."[25] Through a zero-price and cross-subsidy strategy, Google has effectively used Android to protect its dominance in the online search market[26] and foreclose the market for licensable mobile OS. Android's competitors such as Symbian, Windows, Blackberry and others could not endure Google's data-driven, zero-price-based style of competition,[27] since they did not have the required infrastructure, access to data, and/or financial strength to compete on these terms. In turn, Android secured Google's access to a permanent and valuable stream of data from Android users, which strengthens its dominance in the online search market. As a consequence, there are no credible alternatives to Google search, and if consumers do not want to use Android (for example, given its data protection policy), they are only left with Apple's iOS.

Consumer choice has also been impaired through other routes. Consumers are increasingly worried about the protection of their personal data, and want more privacy-friendly options. However, privacy protection is the kryptonite of online advertising-funded business models. Mergers and acquisitions have proven very successful in quashing this threat. Think of WhatsApp's 1-dollar-a-user subscription fee business model that sought to protect users' privacy. When acquired by Facebook in 2014, WhatsApp had a business model that was not designed for fast revenue growth, only user growth. Its business model consisted of providing a free service for a year and then charging an annual 1-dollar subscription fee thereafter. WhatsApp had an aversion to adopting an advertising model for a social messenger service, because WhatsApp founders were especially committed to protecting user privacy given the 2013 mass surveillance revelations in the Edward Snowden affair. After WhatsApp's acquisition by Facebook, the latter amended WhatsApp's privacy policy to allow data to be shared with Facebook,[28] to the detriment of those consumers who prefer higher levels of data protection.

Another example of reduced consumer choice can be seen from Amazon's expansion efforts. As explained, Amazon is both a book publisher and marketer. Consequently, it can produce and promote its own content on Amazon Marketplace, to the detriment of publishers that offer their content on that platform. This advantage has put pressure on booksellers and publishers, thereby spurring consolidation amongst them in the US.[29] This trend has had deleterious effects on both authors and readers, "leaving writers with fewer paths to market and readers with a less diverse marketplace."[30] Additionally, given book publishers' dependence on Amazon Marketplace, Amazon is able to impose higher fees on them, thereby affecting publishers' business model in a way that impairs consumer choice even further, as publishers are less able to invest in a range of books. Publishers have reportedly responded to Amazon's fees by both publishing fewer titles and focusing mainly on books by celebrities and bestselling authors, as a result of which readers are "presented with fewer books that espouse unusual, quirky, offbeat, or politically risky ideas, as well as books from new and unproven authors."[31]

25 Kent Walker, *Android's Model of Open Innovation*, Google, (April 20, 2016) https://www.blog.google/around-the-globe/google-europe/androids-model-of-open-innovation/.

26 Press Release Commission fines Google €4.34 Billion for Illegal Practices Regarding Android Mobile Devices to Strengthen Dominance of Google's Search Engine (July18, 2018).

27 Jeff Dunn, *There's No Hope of Anyone Catching up to Android and IOS*, Business Insider, 22 August 2016.

28 Tas Bindi, *WhatsApp, Facebook to Face EU Data Protection Taskforce*, ZDNet (October 27, 2017) https://www.zdnet.com/article/whatsapp-facebook-to-face-eu-data-protection-taskforce/.

29 Khan, *supra* note 21, 766.

30 *Ibid.*

31 Letter from Authors United to Willian J. Baer, Assistant Attorney General, Antitrust Division, Department of Justice (July 14, 2015). http://www.authorsunited.net/july/.

3. Vertical Integration

Finally, vertical integration enhances the incentive and ability to engage in exclusionary conduct. By the late 2000s and early 2010s, in response to the challenge posed by vertical search, Google began to make copies of the most successful specialized search engines like Kayak, Foundem, and Yelp (leading to Google Travel, Google Shopping, and Google Local). Since the "clones" were not as popular and successful with users as the original vertical search engines, Google introduced what was called "universal search." In a nutshell, universal search displayed links to Google's own vertical search services in a more advantageous manner than to its competitors, thereby effectively diverting traffic from Google's vertical competitors to its own versions of those companies.[32] The European Commission recently imposed a €2.42 billion fine on Google on this account.[33] Relatedly, the European Commission also imposed a €4.34 billion fine on Google for having "used Android as a vehicle to cement the dominance of its search engine."[34] In particular, it was found that Google required manufacturers to pre-install the Google Search app and browser app (Chrome), as a condition for licensing Google's app store (the Play Store). Moreover, that Google made payments to certain large manufacturers and mobile network operators on condition that they exclusively pre-installed the Google Search app on their devices. It was also found that Google prevented manufacturers wishing to pre-install Google apps from selling even a single smart mobile device running on alternative versions of Android that were not approved by Google (so-called "Android forks").[35] Some argue that Amazon has also availed itself of its infrastructure to engage in exclusionary conduct that distorts the competitive process. For example, sellers who use Amazon's delivery system have more chances of being listed higher on Amazon search results than those who do not, which means that Amazon conditions its search engine results on Amazon Marketplace on whether such sellers also use Amazon's delivery business.[36]

III. ARTIFICIAL INTELLIGENCE, MACHINE LEARNING, AND THE IMPLICATIONS FOR COMPETITION POLICY

The development of artificial intelligence ("AI") is described by the OECD in the following way: "(…) *AI became more effective tool after the development of algorithms that teach machines to learn, an idea that evolved from the study of pattern recognition and learning theory, and which would establish the new branch of machine learning.*"[37] A key element of AI is its ability to simulate or reproduce thinking patterns that have naturally been exclusive to human beings. Its effects – as almost any kind of technological development – could be either positive or negative depending on how AI is deployed. An algorithm could be useful to improve, for example, decision-making processes such as comparing prices for goods and services at a large scale. However, the downside is that algorithms could have been designed for less benign purposes such as maximizing profits as opposed to helping consumers find the best prices.

A. Price Algorithms

As more companies and industries switch to computer algorithms to improve their pricing models, customize services, and predict market trends, big data and big analytics can provide novel ways to achieve and sustain collusion, even without a formal agreement or human interaction. In a traditional cartel case, executives of competitors secretly reach an agreement to fix prices, allocate markets or restrict output. However, under current technology computer algorithms can be used as the messenger that is programmed by the cartel members to implement the agreement and monitor and punish any deviation from it. For example, in 2015 the DOJ charged the members of a price-fixing cartel agreement, the purpose of which was to fix, increase, maintain and stabilize the prices of some posters sold in the US on Amazon Marketplace. In order to implement the agreement, David Topkins and his co-conspirators "agreed to adopt specific pricing algorithms for the sale of the agreed-upon posters with the goal of coordinating changes to their respective prices."[38] Here the algorithm was just an extension of the humans' cartel agreement, and therefore this case is an example of express collusion.

32 Michael Luca & Tim Wu, *Is Google Degrading Search? Consumer Harm from Universal Search* (Harvard Business School, Working Paper No 16-035, 2015).

33 Press Release Commission Fines Google €2.42 Billion for Abusing Dominance as Search Engine by Giving Illegal Advantage to Own Comparison Shopping Service (June 27, 2017).

34 Press Release, *supra* note 26.

35 Press Release, *supra* note 26.

36 Khan, *supra* note 21, 779.

37 Algorithms and Collusion Competition Policy in the Digital Age (OECD Report, May 16, 2017)

38 *United States v. Topkins*, CR 15-00201 WHO Plea Agreement 4 (ND Cal 2015).

The effects of price discrimination on welfare are ambiguous. However, an argument can be made in the sense that, given the effectiveness of pricing algorithms in extracting consumers' wealth, "almost perfect" price discrimination may justify intervention. Indeed, price discrimination is likely to enable a dominant firm or a group of firms to exploit consumers and increase barriers to entry or expansion.[39] In this connection, the UK Competition and Markets Authority found that "where a firm uses consumer data to separate different groups of customers and offers a different price to each group, [small competitors or entrants] would not have a substantial fixed base of existing customers, and so may be unable to compete as successfully to target customers through offering them lower prices."[40]

B. Collusion

Computer algorithms can be also used to facilitate the conditions necessary for stable tacit collusion.[41] Traditionally, a large number of competitors make it harder to designate a hub for coordination, monitor deviations, and implement effective punishments for cheating members. However, algorithms can allow for coordination, monitoring and punishment to take place also in less concentrated markets, as their ability and speed in collecting and analyzing data makes the number of firms to monitor and agree with less relevant.[42] In addition, algorithms have the inherent ability to increase market transparency[43] and frequency of interaction amongst competitors,[44] features that make industries more prone to collusion.[45] Indeed, the French and German competition authorities have noted that "[e]ven though market transparency as a facilitating factor for collusion has been debated for several decades now, it gains new relevance due to technical developments such as sophisticated computer algorithms. For example, by processing all available information and thus monitoring and analyzing or anticipating their competitors' responses to current and future prices, competitors may easier be able to find a sustainable supra-competitive price equilibrium which they can agree on."[46]

In their book *Virtual Competition*, Ezrachi & Stucke explore a number of scenarios where algorithmic technology enhances the risk of collusive outcomes. In one of those scenarios, which they call "the Predictable Agent," each competitor programs its algorithm to monitor price changes and swiftly react to any competitor's price reduction. In addition, they also program their algorithms to follow price increases when sustainable, that is to say, where others timely follow price rises in such a way that no competitor benefits from keeping prices lower.[47] Since these algorithms can assess and adjust prices within milliseconds, they can readily match a rival's discount, thereby eliminating the incentive to discount in the first place.[48] Accordingly, in a scenario dominated by similar pricing algorithms that enable a situation of interdependence, there is a real risk of higher prices.[49] Additionally, pricing algorithms may allow for more effective price discrimination. In economics, perfect price discrimination (also known as first-degree price discrimination) amounts to a scenario where a seller charges each customer the maximum price they are willing to pay (i.e. their reservation price). In a perfect price discrimination scenario, the seller captures the entirety of consumers' surplus (the difference between the price a consumer pays for a given product or service and his reservation price). Whilst this scenario has been hitherto more theoretical than real, pricing algorithms, fed by a constant stream of up-to-date data on consumer preferences and revealed interests, may categorize consumers in narrow groups and charge each of such groups different prices determined on the basis of their estimated reservation price.[50] The effects of learning-by-doing are the key enablers of this development. Pricing algorithms can observe and assess the reaction of users and predict how a user will likely react under certain circumstances. Based on predictive capabilities, users are categorized in subgroups of like-minded, like-price-sensitive individuals that share common biases, interests and preferences. This subgrouping also enables the algorithm

39 Ezrachi & Stucke, *supra* note 2, 118–119.

40 CMA Report, *supra* note 9, 3.48.

41 *Brooke Group, v. Brown & Williamson Tobacco Corp*, 509 US 209, 227 (1993).

42 OECD Report, *supra* note 37.

43 *Ibid*. 22.

44 OECD Report, *supra* note 37, 22.

45 *Ibid*. 21.

46 Autorité de la Concurrence & Bundeskartellamt, *Competition Law and Data* (2016) 14–15.

47 Ezrachi & Stucke, *supra* note 2, 61.

48 *Ibid*. 62.

49 Ezrachi & Stucke, *supra* note 2, 62.

50 For a discussion of data as enabler of price discrimination see generally Nathan Newman, *The Costs of Lost Privacy: Consumer Harm and Rising Economic Inequality in the Age of Google*, 40 William Mitchel Law Review (2014).

to approximate the user's reservation price, observe behavior and adjust in a more accurate fashion. Accordingly, "the more times the algorithm can observe what you and others within your grouping do under various circumstances, the more experiments it can run, the more it can learn through trial and error what your group's reservation price is under different situations, and the more it can recalibrate and refine."[51]

IV. CONCLUSION

It is clear that data is, maybe by far, the most salient feature for algorithmic technology. Under a consumer welfare approach to competition policy, it could be argued that the consumer benefits flowing from the use of algorithms in the digital economy are amplified as a result of data-driven efficiencies. However, it is questionable whether the only way to achieve such efficiencies is through increased concentration of data in the hands of a few firms. How to deal with data remains a challenge for competition policymakers in the years to come. Whether there will be industry wide regulation and/or more active enforcement action remains to be seen. Regulation and enforcement action are not mutually exclusive – simply different ways of dealing with digital markets. Antitrust intervention takes time. This means that it may fail to achieve its structural goals altogether, but regulation is difficult in fast moving innovative markets.

51 Ariel Ezrachi & Maurice E. Stucke, *Supplementary Written Evidence (OPL0043) – Online Platforms and the EU Digital Single Market* (September 12, 2016). http://data.parliament.uk/writtenevidence/committeeevidence.svc/evidencedocument/eu-internal-market-subcommittee/online-platforms-and-the-eu-digital-single-market/written/23223.html#_ftn32.

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