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Competition (law) in the era of algorithms

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Abstract: *Algorithm-driven computer programs have become key instruments for market success in a digitalized economy. They can generate positive effects on consumer welfare and welfare in general. On the other hand, algorithms may foster tacit collusion, adversely affect consumer choice, even pose a threat to pluralism. Especially since algo-driven market interactions call traditional economic models into question, it is still unclear whether and how the new challenges can be addressed within the existing framework of (competition) law or whether new legal tools, such as algorithm-focused regulation, must be developed. To approach these questions, the Center for Intellectual Property and Competition Law (CIPCO) at the University of Zurich held a workshop in February 2018. The first part of the workshop focused on technical and economic fundamentals, the second on effects on consumers, and the third part on the existing case-law, as well as on the practice and policy of competition agencies. The present paper reflects the discussions and results of the workshop.*

German Abstract*: Algorithmen sind unentbehrliche Werkzeuge auf digitalen Märkten. Ihr Einsatz kann sich positiv auf das Allgemein- und Verbraucherwohl auswirken, sie können aber auch unerwünschtes Parallelverhalten von Wettbewerbern fördern, die Wahlfreiheit der Verbraucher einschränken, ja sogar zur Bedrohung für eine pluralistische Gesellschaft werden. Nicht zuletzt weil algorithmische Marktaktivität manch traditionelles ökonomisches Marktmodell infrage stellt, ist derzeit unklar, ob diese neuen Herausforderungen mit den etablierten Instrumenten des (Kartell-)Rechts adressiert werden können oder ob es neuer Instrumentarien, etwa einer spezifischen Regulierung, bedarf. Das Center for Intellectual Property and Competition Law (CIPCO) der Universität Zürich hat diese Fragen im Februar 2018 zum Gegenstand eines Workshops gemacht. Im Fokus standen technische und ökonomische*

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[3] https://www.rwi.uzh.ch/de/oe/cipco.html (all web resources last consulted 26 April 2018).

Grundlagen, die Verbraucherperspektive, das bereits existierende Fallrecht sowie die Praxis und Grundsatzpositionen der Wettbewerbsbehörden. Der vorliegende Beitrag fasst die Diskussionen und Ergebnisse des Workshops zusammen.

***Keywords**: Algorithm; algorithmic consumer; tacit collusion; explicit collusion; Lufthansa; Uber; Kalanick; Eturas; CIPCO; Topkins; price discrimination; digital butlers; concerted practices; collusive equilibrium; deep learning.*

I. Introduction

Algorithm-driven computer programs have become key instruments for market success in a digitalized economy. On the one hand, they can certainly generate positive effects on consumer welfare and welfare in general. On the other hand, algorithms may foster tacit collusion, adversely affect consumer choice, even pose a threat to pluralism. Especially since algo-driven market interactions call traditional economic models into question, it is still unclear whether and how the new challenges can be addressed within the existing framework of (competition) law or whether new legal tools, such as algorithm-focused regulation, must be developed.

To approach these questions, the Center for Intellectual Property and Competition Law (CIPCO) at the University of Zurich held a workshop on Monday 19th February 2018 in Zurich.[4] The first part of the workshop focussed on technical and economic fundamentals, the second on effects on consumers, and the third part on the existing case-law, as well as on the practice and policy of competition agencies. Key note speakers represented a mix of agency officials, academics and practitioners. Among them were Antonio Capobianco, LL.M. (Senior Competition Law Expert, OECD), Prof. Michal Gal, LL.M. (Professor, University of Haifa), Dr. Hubert Orso Gilliéron (Partner, Baker McKenzie), Prof. Andreas Heinemann, DIAP (ENA, Paris) (Professor, University of Zurich, President of the Swiss Competition Commission), Dr. Pranvera Këllezi LL.M. (Kellezi Legal, member of the Swiss Competition Commission), Prof. Daryl Lim, LL.M. (Professor & Director, Center for Intellectual Property, Information and Privacy Law at John Marshall Law School), David Mamane LL.M. (Partner, Schellenberg Wittmer), Prof. Salil K. Mehra (Professor & Director of the LL.M. in Asian Law, Temple University), Dr. Marcel Meinhardt LL.M. (Partner, Lenz&Staehelin)

[4] https://www.rwi.uzh.ch/dam/jcr:08b6d5cc-4cc2-4134-9eb5-de9aa34231fc/Flyer%20CICPO%20Round%20Table_19.02.2018.pdf.

Cyril Ritter (Policy officer, DG COMP, EU Commission), Prof. Rolf H. Weber (Professor emeritus, University of Zurich, and Counsel, Bratschi AG), and Prof. Peter Georg Picht LL.M. (Professor, University of Zurich). Following the workshop, its results were presented to a wider audience by way of a round table discussion hosted jointly by CIPCO and the Europa Institute at the University of Zurich.

To encourage an open exchange of ideas, workshop participants agreed that information shared during the workshop may be used freely but that statements should not be assigned to a specific participant (Chatham House Rule).

II. Session 1 – Technical and Economic Fundamentals

The first part of this session[5] aimed at describing the inner workings of algorithm-driven computer software, with a main focus on algorithmic pricing. The second part focused on economic aspects, in particular the economic rationale underlying (the legal treatment of) tacit collusion and the question how algorithm-driven computer programs might foster this type of conduct.

Technical Fundamentals

The use of algorithm-driven software is, in itself, not an entirely new phenomenon. Today's possibilities of collecting and processing vast amounts of data without direct human intervention, however, makes a difference. The technical developments coincide with, and partly drive, a shift in focus from supply chain optimization to demand chain optimization. Algorithmic computer programs independently collect large amounts of data, *inter alia* by monitoring algo-driven transactions with consumers, analyse it, and utilise the results in setting consumer prices, at a speed that is impossible for humans to reach.[6]

In order to perform its core functions, namely monitoring and repricing, a pricing algorithm needs to be coded and the user has to set the parameters according to the task at issue. By appropriately selecting these parameters, it is also possible to have the algorithm

[5] For further reading, see Salil K. Mehra, Antitrust and the Robo-Seller: Competition in the Time of Algorithms, Minnesota Law Review, Vol. 100 (2016), p. 1323 et seqq.; OECD (2017), Algorithms and Collusion: Competition Policy in the Digital Age, http://www.oecd.org/daf/competition/Algorithms-and-colllusion-competition-policy-in-the-digital-age.pdf.

[6] See also Mehra, fn (5), p. 1346.

follow a certain strategy, for instance to always match the highest price of a competitor.[7]

As this example shows, even more traditional, non-learning algorithms need not be limited to monotonously performing a pre-defined set of rules without reacting to their environment. They can be told to take external conditions, such as competitors' pricing strategies, previous consumer choices, or even the weather, into consideration. At this level of sophistication, it is, however, still the user who defines the relevant external parameter and the formula according to which the algorithm shall react to changes in the parameter.[8]

So-called "deep learning" algorithms go a step further. Their underlying concept is the replication of the human brain by creating an artificial neural network similar to the structure of biological neurons driving humans' thoughts and actions.[9] Contrary to "ordinary" algorithms, deep learning algorithms are able make decisions based on their own neural network, i.e. to a large extent independently of pre-set rules and parameters. In particular, they can find patterns in a given set of data and develop, by monitoring their own operations, a suitable reaction or strategy with regard to these patterns. The output which deep learning algorithms produce over time can be hard to predict or steer even for those who have developed or implemented them. Not only are the programs oftentimes much faster and more efficient in identifying patterns and corresponding strategies than human brains could ever be, they may also find patterns a human would not detect. Furthermore, deep learning algorithms do usually not provide information about the decision-making process going on inside them, which turns them into something like a "black box".[10]

Evidently, the level of control and predictability present in the relation between algorithms and their developers/implementers can be of importance in tailoring appropriate conduct requirements and legal sanctions. Although the sweeping implementation of complex deep learning algorithms seems to lie still in the future, the development of a legal framework for algorithms of a more limited capacity is an urgent task. For instance, the e-commerce sector inquiry undertaken

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[7] Setting good strategies can be a tricky task: In 2011, the biology textbook "Making of a Fly" offered on Amazon was traded for a price of over 23 million US-Dollars, apparently because two pricing algorithms were pursuing strategies that drove, in their interaction, the price to an absurd level; see Michael Eisen, Amazon's $23,698,655.93 book about flies, It is NOT Junk (April 22, 2011), http://www.michaeleisen.org/blog/?p=358.

[8] See also Mehra, fn (5), p. 1336.

[9] OECD (2017), fn (5), p. 11.

[10] The question of how to deal with deep learning algorithms was further discussed in the third session, cf. below.

by the European Commission revealed that the use of pricing algorithms has become common place: 53% of the responding retailers track online prices of competitors, 67% of these retailers do the tracking by way of software, and 78% of the responding retailers adjust their prices based on the tracking results.[11]

Economic Fundaments – rethinking tacit collusion?

The concept and traditional legal treatment of explicit and tacit Collusion

Collusion is usually understood as a form of coordination among competitors that aims at raising profits to a level which is higher than the non-cooperative equilibrium, thus creating a deadweight loss.[12] While "explicit collusion" is based on an agreement or some other form of concertation between the involved market players, "tacit collusion", also called "parallel behaviour", requires no such concertation and can, in particular, spring from market players monitoring and reacting to each other's independent business decisions.[13] A classical model for describing this type of behaviour is the Cournot duopoly.[14] In this model, two firms act independently but they are aware of each other's actions. Hence, they do not explicitly agree on prices and make their choices independently, but they are aware of each other's production functions and calculate their economic response accordingly.[15] In consequence, each firm will price at a supra-competitive level rather than competing away – as in a market with perfect competition – all profit to costs.[16]

From an economic point of view, both types of collusion are undesirable.[17] Even where collusion is only tacit, it is likely to result

[11] Commission Staff Working Document, Preliminary Report on the E-commerce Sector Inquiry, Brussels, 15.9.2016, SWD(2016) 312 final, Part 1/2, n 125, http://ec.europa.eu/transparency/regdoc/rep/10102/2016/EN/SWD-2016-312-F1-EN-MAIN-PART-1.PDF.

[12] OECD (2017), fn (5), p. 19; see also Hal R. Varian, Intermediate Microeconomics – A modern Approach, Ninth Edition, New York/London, 2014, p. 531 et seqq.

[13] OECD (2017), fn (5), p. 19; see also OECD (2015), Competition Enforcement in Oligopolistic Markets, DAF/COMP(2015)2, n 13, https://one.oecd.org/document/DAF/COMP(2015)2/en/pdf; Michael K. Vaska, Conscious Parallelism and Price-fixing: Defining the Boundary, University of Chicago Law Review, Vol. 52 Issue 2 (1985), p. 508 et seqq., p. 509, p. 519 et seq.

[14] Augustin Cournot, Recherches sur les Principes Mathematiques de la Théorie des Richesses, Paris: L. Hachette, (1838) ; Varian, fn (12), p. 526 et seqq.; see also Mehra, fn (5), , p. 1347.

[15] Mehra, fn (5), on how tacit collusion can be promoted by pricing algorithms under a Cournot model, p. 1343 et seqq.

[16] Mehra, fn (5), p. 1345.

[17] OECD (2017), fn (5), p. 19.

in supra-competitive prices, lower output, deadweight losses, and, ultimately, a reduction in (consumer) welfare.[18]

Competition law, however, prohibits – at least in Switzerland, the EU and the US – only explicit collusion but tolerates tacit collusion.[19] One reason is the concern that banning tacit collusion may inhibit market players from intelligently adapting their business strategy to their competitors' prices or other market conditions (demand, cost, etc.), after all a key component of competitive behaviour.[20] Another probably lies in competition law's traditional role as an "anti-cartel law", focussed on fighting illicit agreements which do not exist in tacit collusion-scenarios.[21]

Likelihood of tacit collusion in algorithmic markets

Traditionally, the likelihood for tacit collusion appeared high in (1) oligopolistic markets[22] for (2) homogeneous goods and services,[23] especially where (3) transparency[24] and (4) entry barriers[25] are high.[26] Not very many markets pronouncedly display these features and, consequently, the relevance of tacit collusion seemed hitherto to be limited.[27] It was not least against this background that competition law

[18] See Mehra, fn (5); OECD (2017), fn (5).

[19] For Switzerland, see Thomas Nydegger/Werner Nadig, in: Marc Amstutz/Mani Reinert (editors), Basler Kommentar, Kartellgesetz, Basel 2010, art. 4 note 116; for the EU, see Alison Jones/Brenda Sufrin, EU Competition Law, Text, Cases, and Materials, sixth edition, Oxford 2016, p. 694; Ariel Ezrachi/Maurice Stucke, Artificial Intelligence & Collusion: When Computers Inhibit Competition, University of Illinois Law Review, Vol. 2017 Issue 5 (2017), p. 1775 et seqq., p. 1793; for the US, see Mehra, fn (5), p. 1328 with further reference.

[20] For the EU, see Case C-89/85 DEP *A. Ahlström Osakeyhtiö and others v Commission*, ECLI:EU:C:1993:120, n 71; Case C-40/73 *Coöperatieve Vereniging "Suiker Unie" UA and others v Commission*, ECLI:EU:C:1975:174, n 174; see also Jones/Sufrin, fn (19), p. 694 et seqq.; the US, see: *In re: Text Messaging Antitrust Litig., No. 14-2301 (7th Cir. April 9, 2015), ("Slip Op.")*, p. 10 et seq.

[21] OECD (2017), fn (5), p. 19.

[22] Jan Potters/Sigrid Suetens, Oligopoly experiments in the current millennium, Journal of Economic Surveys, Vol. 27 Issue 3 (2013), p. 439 et seqq., p. 448.

[23] Marc Ivaldi/Bruno Jullien/Patrick Rey/Paul Seabright/Jean Tirole, The Economics of Tacit Collusion, Final Report for DG Competition, European Commission, IDEI, Toulouse, March 2003, p. 47, p. 66, http://ec.europa.eu/competition/mergers/studies_reports/the_economics_of_tacit_collusion_en.pdf.

[24] See Christian Schultz, Transparency on the Consumer Side and Tacit Collusion, European Economic Review, Vol. 49 Issue 2 (2003), p. 279 et seqq., p. 280.

[25] OECD (2017), fn (5), p. 20 et seq.

[26] Michal S. Gal, Algorithmic-Facilitated Coordination: Market and Legal Solutions, in: CPI Antitrust Chronicle May 2017, p. 22 et seqq., p. 23 et seq.

[27] Mehra, fn (5), p. 1328; Rolf H. Weber, Disruptive Technologies and Competition Law, in: Klaus Mathis (ed.), New Developments in Competition Law and Economics, Springer, Berlin 2018 (forthcoming), Ch. 4.2.1; see also Autorité de la Concurrence and Bundeskartellamt (2016), Competition Law and

and policy deemed it acceptable to refrain from fighting this type of conduct. If, however, the intensive use of algorithms in a market were to make tacit collusion more likely by removing the relevance of traditional conditions for its successful implementation, the traditional approach towards tacit collusion may have to be reconsidered.

The workshop discussions showed that algorithms may facilitate tacit collusion in at least four ways:[28] First, an increased capacity to collect and analyse large amounts of data helps competitors to understand each other's production functions and business strategies. This effect may be reinforced when business decisions are increasingly taken by rule-based, "rational" algorithms whose patterns can be detected by competitors' algorithms more easily than the sometimes erratic, irrational and unpredictable decisions taken by human beings. Second, transactions which defect from the supra-competitive equilibrium can destabilize tacit collusion as they force competitors to adapt their conditions as well. The use of algorithms reduces the risk that firms make mistakes when they try to meet, with their transaction conditions (prices in particular), the collusive equilibrium. Algorithms can thereby prevent involuntary destabilization of collusive equilibria. Third, algorithms are unlikely to succumb to human biases ("agency slack"), e.g. the human tendency to favour short-term and/or personal gains from violating the collusive equilibrium over long-term and/or company gains from maintaining tacit collusion.[29] And, fourth, algorithms tend to increase the frequency and decrease the latency of transactions between market participants. Price deviation is therefore less likely to go unnoticed for a timespan sufficiently long to yield attractive deviation gains to a price maverick. These four factors may have a particularly strong impact on traditional "brick and mortar" markets for which, hitherto, low transparency, slow transactions, and non-digitalized decision-making were characteristic.

Apart from the possibility to re-interpret the term "agreement" and/or the term "concerted practices" in a broader way than traditionally, other (new) issues also merit attention: The improvement of transparency and accountability (including aspects of data access, data governance and auditability) can help market participants to

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Data,. 14 et seqq, https://www.bundeskartellamt.de/SharedDocs/Publikation/DE/Berichte/Big%20Data%20Papier.html?__blob=publ.

[28] See also for a non-numeric illustration Ariel Ezrachi/Maurice Stucke, Virtual Competition: The Promise and Perils of the Algorithm-Driven Economy, Cambridge (Massachuchusetts/US), (2016), Chapter 2, p. 27 et seqq., see also Mehra, fn (5), passim, and Weber (2018), fn 27, ch. 4.2.2.

[29] Mehra, fn (5), p. 1328; see also Ezrachi/Stucke, fn (19), p. 1792; Jan Blockx, Antitrust in digital markets in the EU: policing price bots, Paper for the Radboud Economic Law Conference, June 2017, S. 3, available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2987705.

better understand the functioning of algorithms. Furthermore, the regulatory redress on autonomous systems as such instead of enterprises might become a viable alternative.[30] Finally, the compliance with the improved protection of privacy rights (General Data Protection Regulation) and with the constitutionally guaranteed non-discrimination principle will gain importance.[31]

Although algorithms can facilitate tacit collusion, it would be wrong to assume that they always bring it about. Further empirical research is needed to quantify increased tacit collusions risks and identify vulnerable market areas. Without the results of such research, competition law and policy should avoid radical changes in their treatment of tacit collusion.

Explicit Collusion

Regarding explicit collusion, the situation is more straightforward. There are several ways in which algorithms can serve as tools for explicit collusion but all of them fall within the scope of competition law. Long-standing case law holds,[32] for instance, that facilitating indirect level pricing e.g. by colluding on a price formula is as illicit as outright price fixing.[33] This does not change if the formula is expressed as an algorithm, the coding and relevant parameters of which are shared between competitors. Another example – and one of the oldest concerns of competition law – is the direct or indirect outsourcing of pricing decisions to a common agent.[34] Whether the common agent uses an algorithm for directly determining the prices that ought to be charged or whether the parties have their individual pricing algorithms coded by the common agent so as to produce collusive pricing strategies, the firms participating in such structures do form a sort of "hub and spoke" cartel[35] and venture into forbidden territory.[36] The sending of collusive signals to competitors is equally forbidden regardless of whether the signalling is done by algorithms sending and receiving coded messages – for instance in the form of patterned, short-term price changes – or by more traditional means.

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[30] For more details see Weber (2018), fn 27, ch. 4.2.4.
[31] Weber (2018), fn 27, ch. 4.3.
[32] See e.g. Case T-48/00 *Corus*, ECLI:EU:T:2004:219, n 82 with further references.
[33] See e.g. Case T-48/00 *Corus*, ECLI:EU:T:2004:219, n 82; see also Jones/Sufrin, fn (19), p. 663 et seq. with further references.
[34] E.g. Commission Decision no. 73/212 of 11 May 1973 in case IV/791 *Société Commerciale des Potasses et de l'Azote (SCPA) and Kali und Salz (formerly VDK)*, OJEU L 217, 6.8.1973, p. 3.
[35] Algorithms and Collusion - Note from the European Union, DAF/COMP/WD(2017)12, n 26, https://one.oecd.org/document/DAF/COMP/WD(2017)12/en/pdf.
[36] Ezrachi/Stucke, fn (28), p. 47 ss.

III. Session 2 –Challenges to Consumers

The second session of the workshop assessed individual pricing, as well as the potential advantages and disadvantages of using algorithms to assist consumers in their decision-making.

Algorithmic consumers[37]

Consumers are already using algorithm-based digital agents quite frequently, for instance in their interaction with online shops or digital social networks.[38] The latest generation of these "digital butlers" does not only assist consumers, for instance by performing web-searches or comparing prices, but makes independent decisions based on the consumer's preferences.[39] Potentially, a digital butler can even identify consumer preferences using data actively provided by the consumer or collected from previous searches or choices. Based on these preferences, the butler can look for an appropriate purchase or other type of transaction and independently execute the transaction on its own or by employing specific shopping bots.

Using digital helpers appears to be convenient and rational. "Wasting" less decisional energy on small, day-to-day choices, humans will be able to invest this energy into their more important decisions. Assuming digital butlers' algorithms are (coded to be) benevolent, they can reduce information and transaction costs, take decisions more speedily, and – most likely – with greater sophistication as they are not subject to typical consumer biases.[40] Regarding adverse price differentiation (cf. below), digital butlers may protect consumers by evaluating pricing structures and turning down or re-negotiating discriminating offers.[41] Psychologically, consumers may be happier when relieved from choices which may lead to undesired results, e.g. bad restaurants or boring novels.

On the other hand, digital agents distance consumers from their transactional choices.[42] Assuming that the ability to make good decisions – the "decision-making muscle", as it were – takes practice

[37] For further reading, see Michal S. Gal/Niva Elkin-Koren, Algorithmic Consumers, Harvard Journal of Law and Technology Vol. 30 Issue 2, p. 309 et seqq., (2017) as well as Michal S. Gal, Algorithmic Challenges to Autonomous Choice, available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2971456.

[38] Gal/ Elkin-Koren, fn (37), p. 314.

[39] Gal/ Elkin-Koren, fn (37), p. 309 et seq.

[40] Gal/ Elkin-Koren, fn (37), p. 318, p. 320 and p. 329.

[41] See Gal/ Elkin-Koren, fn (37), p. 331 et seq.

[42] Gal/ Elkin-Koren, fn (37), p. 322.

in order to operate smoothly, relieving consumers from routine decisions may, in the long run, negatively affect the quality of their important decisions. Furthermore, even the ability of digital agents to play a helpful role in daily life depends on a number of conditions and is, therefore, relatively fragile. If, for instance, humans change their preferences for non-rational reasons or reasons the digital agent cannot (immediately) detect, they may find themselves entangled in a decision-making and transaction mechanism which no longer serves their needs and wishes. The technological capacity of digital butlers or settings made by those who coded their algorithms can limit the range of decisions and actions consumers can make. This may occur, in particular, when consumers are required to employ digital agents, such as - for instance - algorithms used by insurance companies for monitoring behaviour and adapting insurance conditions accordingly. On a more personal note, consumers who have delegated considerable autonomy to their digital butlers may be deprived of social interactions, learn less about life and face contempt by their fellow people for being no longer in command of their own lives.

In sum, while acknowledging the positive potential of digital agents, consumers and competition authorities should remain vigilant and ensure that they understand the inner workings of these tools, that digital butlers' algorithms are designed benevolently, and that they are not employed in inappropriate areas, such as the exercise of voting rights.

Individual Price Differentiation

Individual price differentiation is another way in which algorithms may have a far-reaching impact on consumers.[43] Generally speaking, there are reasons why price differentiation may be efficient and procompetitive, *inter alia* because it can increase output by offering lower prices to less solvent buyers who could not afford to pay an average price.[44]

On the other hand, if consumers are charged the maximum price they are respectively willing to pay, they may perceive their welfare to decrease. In addition, some assumptions on which a positive assessment of price differentiation rests are questionable. For instance, companies may actually charge wealthy consumers lower instead of higher prices because it is particularly lucrative to turn them into long-term customers by offering attractive prices. This pricing pattern has

[43] Ezrachi/Stucke, fn (28), p. 117 et seqq.

[44] See Ezrachi/Stucke, fn (28), p. 118; OECD (2016), Roundtable on Price Discrimination, Background note by the Secretariat, n 32, https://one.oecd.org/document/DAF/COMP(2016)15/en/pdf.

taken place in offline markets[45] and it will plausibly occur in online markets, too. The impact of price differentiation on particular national economies may also matter. In Switzerland, for instance, consumer prices tend to be significantly above European levels.[46] Can it be in the country's interest to accept this form of price differentiation when the positive welfare effects materialize somewhere else while Swiss customers bear the brunt of higher prices? With its recent legislation against geo-blocking,[47] the European Union has, to a certain extent, addressed this "geographical" aspect and the underlying question whether welfare effects of price differentiation are to be considered on a national or on an international level.

In spite of these and other concerns, price differentiation is not illegal in the analogue sphere and it does not become illegal just because it is implemented via the use of (pricing) algorithms. Nonetheless, in the view of the workshop participants, algorithm-based individual price differentiation is – so far – something like a "Loch Ness Monster", often conjured-up but rarely, if ever, reliably detected. Among the reasons which may explain this apparent lack of implementation is the fact that price differentiation comes at a cost. Coding appropriate algorithms, tracking consumers, processing the collected data, determining the conditions to be offered to each individual, and getting customers to accept the individualized offers can require considerable resources. Furthermore, sustainable price differentiation arguably requires some degree of market power as, otherwise, it is too easy for customers to switch to competitors that do not individualize their prices or offer access to a more favourable price bracket.[48] Data protection is a worry not only for those whose data is in need of protection but also for companies whose algorithms may violate data protection laws in the process of determining and implementing individualized prices. Last but not least, consumers might strike back when they realize they are being tracked and price-discriminated. Holding back precious personal data and covering their

[45] See Omer Tene, Privacy: For the Rich or for the Poor?, https://concurringopinions.com/archives/2012/07/privacy-for-the-rich-or-for-the-poor.html, with further references.

[46] See http://ec.europa.eu/eurostat/statistics-explained/index.php/Comparative_price_levels_of_consumer_goods_and_services.

[47] Regulation (EU) 2018/302 of the European Parliament and of the Council of 28 February 2018 on addressing unjustified geo-blocking and other forms of discrimination based on customers' nationality, place of residence or place of establishment within the internal market and amending Regulations (EC) No 2006/2004 and (EU) 2017/2394 and Directive 2009/22/EC, OJ L 60I, 2.3.2018, p. 1–15.

[48] See Terrell McSweeny/Brian O'Dea, The Implications of Algorithmic Pricing for Coordinated Effects Analysis and Price Discrimination Markets in Antitrust Enforcement, Antitrust Magazine, Vol. 32 Issue 1 (2017), p. 75 et seqq., p. 76; Penelope Papandropoulos, How should price discrimination be dealt with by competition authorities?, Droit & Économie, Concurrences N°3-2007, p. 34 et seqq., p. 34.

tracks by browsing incognito, consumers could not only thwart effective price differentiation but also endanger online business models based on data collection and targeted advertising.

IV. Session 3 – Regulatory Issues and Present Practice

Regulatory Issues

Since Swiss competition law does not contain an explicit provision on algorithm-driven market behaviour, its general rules apply, in particular the rules on (explicit) collusion. Recent case-law by the Swiss Federal Court[49] and the Swiss Federal Administrative Court[50] has reinforced the convergence between Swiss and EU competition law in this area, *inter alia* regarding awareness of the involved players as a prerequisite for explicit collusion. In order to establish the existence of an unlawful agreement or concerted practice, an element such as "concurrence of wills", "awareness", or "consensus" has to be established, presupposing individual knowledge of the coordination. The awareness-requirement is of pivotal importance in the assessment of algorithm-driven collusion as it separates accidental, anti-competitive mishaps in the results algorithms produce from planned and concerted anti-competitive strategies worthy of competition law sanctions.

In 2016, the Swiss Competition Commission ("ComCo") conducted an inquiry into market sectors on which digitalisation has a particularly strong impact. Among them were network infrastructure, online trading, sharing economy business models, big data applications, and (other) digital platforms. The results of this sector inquiry confirmed that, on the one hand, algorithm-driven automated pricing can intensify competition to the benefit of consumers while, on the other hand, there are concerns that strategic coding or the interaction between algorithms can lead to harmful coordinated pricing. Among the types of potential anti-competitive price coordination, restrictive or exploitative price differentiation between Swiss markets and EEA markets is particularly relevant to the Swiss economy. It can be challenging to effectively fight algorithms which implement anti-competitive pricing strategies if these algorithms are being run on servers located abroad since ComCo's investigational competences end at the Swiss borders. In case of uncertainty about whether their algorithms comply with competition law, firms may – at

[49] See e.g. judgement of the Swiss Federal Court of 26 June 2016, BGE 143 II 297, consid. 5.3.4.

[50] See e.g. judgment of the Swiss Federal Administrative Court of 19 December 2017, BVGer B-844/2015, consid. 7.1., as well as the judgment of the Swiss Federal Administrative Court of 14 November 2017, BVGer B-552/2015, consid. 4.1.

least in theory – submit the software to the ComCo for analysis in the framework of an "ex-ante audit", a particularity of Swiss competition law. If ComCo did not initiate a preliminary investigation as a result of the audit, firms would no longer risk to be sanctioned for using the respective software.

Contrary to the Swiss Cartel Act, the Swiss Financial Market Infrastructure Ordinance ("FMIO")[51] contains provisions dealing with algorithms and high-speed trading. Inspired by "MiFID II",[52] the FMIO stipulates that algorithmic trading systems must "not cause or contribute to any disruptions in the trading venue".[53] As a consequence, algorithmic orders have to be identified and algorithmic financial instruments have to be designed and tested in an appropriate way.[54] As financial markets generate substantial experience in the use of algorithmic market behaviour and in the effectiveness of relatively detailed provisions on such behaviour, competition law should keep an eye on the potential lessons to be learned from this sector.

From an EU-viewpoint and regarding non-learning algorithms, most of the cases in which algorithms are used to achieve explicit collusion qualify quite clearly as anti-competitive, illegal behaviour. These cases tend to be challenging not on the conceptual but on the evidentiary side as it can be difficult to establish requirements such as "intent" or "agreement" with regard to the workings of algorithms. Assessing cases which lean towards tacit instead of explicit collusion, (EU) competition authorities should be cautious not to overstretch the existing competition law framework. A more frequent occurrence of tacit collusion in algorithm-driven markets does not as such justify overenforcement.

Regarding deep-learning algorithms, the situation is less clear. This type of algorithm may develop collusive strategies autonomously, i.e. without the strategy being encoded in the algorithm from the beginning. Furthermore, deep-learning algorithms may present themselves as "black boxes" the workings and interactions of which are hard to decipher in detail. The challenges these features present to traditional competition law notions, such as causality or intent, may be reduced by focussing on the outputs and their correlations resulting from the (inter-)action of deep-learning algorithms. Where unwanted outputs and correlations are detected, competition law can – under this approach – request the creators

[51] Ordinance on Financial Market Infrastructures and Market Conduct in Securities and Derivatives Trading of 25 November 2015, SR 958.11.
[52] Directive 2014/65/EU of the European Parliament and of the Council of 15 May 2014 on markets in financial instruments and amending Directive 2002/92/EC and Directive 2011/61/EU, OJ L 173, 12.6.2014, p. 349–496.
[53] See art. 31 para. 2 lit. c FMIO.
[54] See art. 31 para. 2 lit. e FMIO.

and/or implementers of deep-learning algorithms to modify theirs tools without having to show that further requirements are met.

Although the current political climate favours more (competition) law enforcement in the digital sector, it seems important not to hasten new legal rules or even a detailed regulatory framework.[55] Regulation should be considered to address recurrent issues which produce – as substantive experience tells – almost always negative outcomes. Furthermore, new competition law rules ought to preserve – as far as possible – technological neutrality, i.e. apply regardless of the technology which is used to implement a certain conduct. Against this background, new competition law rules, let alone detailed regulation, specifically addressing types of algorithms that are at a forefront of technological development might, at present, be premature.

Present Practice

Several cases have already been decided in the US and the EU which deal with collusion in an algorithmic context. The other features and competition law issues of these cases, however, differed considerably, which makes it hard to derive general trends from the case-law.

United States v. David Topkins[56]

The *Topkins* case concerned a price-fixing agreement under which the cartelists used pricing algorithms to fix prices of posters sold online. They agreed explicitly to coordinate their pricing by using the same algorithm embedded in their software. Interestingly, the affected market was not particularly vulnerable to cartelization by traditional standards as transaction intensity was relatively low and neither products nor prices were homogeneous. The fact that explicit

[55] See e.g. OECD (2017), fn (5), p. 52; see also Maureen K. Ohlhausen, Should We Fear The Things That Go Beep In the Night? Some Initial Thoughts on the Intersection of Antitrust Law and Algorithmic Pricing, p. 8, https://www.ftc.gov/system/files/documents/public_statements/1220893/ohlhausen_-_concurrences_5-23-17.pdf.

[56] 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; see also Salil K. Mehra, U.S. v. Topkins: can price fixing be based on algorithms?, Journal of European Competition Law & Practice, Vol. 7 Issue 7 (2016), p. 470 et seqq.; Virgílio Pereira, Algorithm-driven collusion: pouring old wine into new bottles or new wine into fresh wineskins?, European Competition Law Review, Vol. 39 Issue 5 (2018), p. 212 et seqq., p. 214 et seq.

collusion on prices worked nonetheless corroborates the assumption that algorithms may spread collusion beyond its traditional contexts.

The case was the first of its kind and David Topkins the first defendant in a criminal prosecution against a conspiracy aimed at e-commerce. Being charged with a violation of Section 1 of the Sherman Act made it clear that competitors using algorithmic pricing must keep their price setting independent. Future, similar cartels may at least be smarter in that they avoid explicit agreements on using the same pricing algorithm.

Meyer v. Kalanick (Uber)[57]

The case Meyer v Kalanick (also called Uber-southern district of New York case) is still on-going and has a special feature to it as Uber is not a party to the case, but Travis Kalanick, (former) CEO of Uber, was personally involved. Travis Kalanick in addition to being the CEO was also an Uber driver. It is alleged by Spencer Meyer, an Uber customer from Connecticut that the Uber application allows third-party drivers to illegally fix prices. The U.S. District Court (Southern District of New York) held that Spencer Meyer's claims were sufficient to assume a hub and spoke agreement between the Uber drivers and Travis Kalanick, as there was a vertical agreement between the drivers and Travis Kalanick setting prices for Uber rides. After it had been unclear whether the dispute would go to trial or whether it would be arbitrated,[58] District Court Judge Rakoff released, on 5 March 2018, an opinion setting forth that (despite his own misgivings) the case would head to arbitration.[59]

[57] Meyer v. Kalanick, No. 1:2015cv09796, Doc. 37, Opinion on Motion to Dismiss, (S.D.N.Y. 2016).

[58] In August 2017, the Second Circuit referred the case back to the District Court in order to determine whether Uber waived his right to mediate through active litigation. Meyer v. Uber Techs., Inc., 866 F.3d 66, 94; see also Chanakya Basa, Does price fixing, by app based on-demand taxi services pose a competition law concern in India?, https://www.competitionpolicyinternational.com/does-price-fixing-by-app-based-on-demand-taxi-services-pose-a-competition-law-concern-in-india/#_ftnref6.

[59] https://www.sdnyblog.com/files/2018/03/15-Civ.-09796-2018.03.05-Opinino-Compelling-Arbitration.pdf.

Lufthansa Group[60]

The German Federal Cartel Office (Bundeskartellamt) is currently conducting a preliminary investigation to determine whether it will initiate proceedings against the Lufthansa Group for excessive pricing. The group runs a fully-automated, algorithm-driven booking system. Following the insolvency of a competitor (Air Berlin), prices for tickets offered by the Lufthansa Group increased, on certain routes, by 30%. The Bundeskartellamt is now assessing whether this amounts to excessive pricing. As one algorithm-related facet, the case raises the question of whether and in which way a competitor's insolvency – or similar changes in market structure – can legitimately serve as a pattern guiding a pricing algorithm. This question becomes more fundamental if the insolvency brings about market dominance of the remaining player, and with it the limitations competition law imposes on the acceptable (pricing) conduct of a market dominant firm. Does competition law oblige companies to adapt their pricing algorithms to changes in their market position, in particular to the acquisition of dominance? And if so, should a grace period apply to give companies a realistic chance for altering their algorithms?

Eturas UAB and Others[61]

In the *Eturas* case, 30 travel agencies in Lithuania used the online booking system E-TURAS, owned by the company *Eturas*. Eturas imposed – through its booking system – a technical restriction on the discount rates the travel agencies could offer to their clients. It posted a notice in the system informing the travel agencies about the new discount policy. The notice was not sent via ordinary e-mail but through a message system incorporated into the booking system. The notice could only be read using a password-protected gateway. The Lithuanian Competition Council declared this behaviour to be an illegal concerted pricing by the travel agencies. The case was appealed to the Lithuanian Supreme Administrative Court which sought clarification as to the correct interpretation of Article 101 TFEU through a preliminary ruling by the ECJ.

In the ECJ's application of Art. 101 TFEU to the electronic sales system, it constituted the main issue whether the addressees were – or

60 http://www.bundeskartellamt.de/SharedDocs/Interviews/DE/2018/180127_NOZ.html.

61 Case C-74/14 '*Eturas' UAB and Others v. Lietuvos Respublikos konkurencijos taryba*, ECLI:EU:C:2016:42; see also Andreas Heinemann/Aleksandra Gebicka, Can Computers Form Cartels? About the Need for European Institutions to Revise the Concertation Doctrine in the Information Age, Journal of European Competition Law & Practice, Vol. 7 Issue 7 (2016), p. 431 et seqq.

ought to have been – aware of the system notice announcing the rebate caps. The Court stated that participation in a concertation cannot be inferred from the mere existence of a technical restriction implemented in a system.[62] It has to be established on the basis of other objective and consistent indicia that undertakings tacitly assented to an anticompetitive action.[63] This seems to mean that technology alone cannot violate Art. 101 TFEU and leads on to the question of whether existing competition law rules can be applied at all to autonomous computer systems which no longer require interaction with natural persons.[64] Is the requirement that natural persons must be aware of a violation still appropriate or has it become overly "anthropocentric" in algorithmic markets? How do the concepts of 'concurrence of wills', 'meeting of the minds' and 'intention' refer to computerized systems which require less and less human intervention?[65] Should there not be a transition from an anthropocentric point of law to a holistic concept encompassing enterprises in their entirety? If this were the case, awareness by natural persons would lose its pivotal importance and in future a cartel of machines would also amount to a cartel of the connected firms, just as today a cartel of employees of competing undertakings amounts to a cartel in its proper sense.[66]

V. Conclusion

Using algorithmic software to perform market activity is neither an entirely new phenomenon nor one that would automatically mandate much fiercer competition law enforcement. The spreading of "static", non-learning algorithms may, however, facilitate collusion in markets that were not, hitherto, prone to such conduct (cf. *Topkins*). Explicit collusion violates competition law, regardless of whether it is implemented by algorithms or more traditional tools (cf. *Topkins*, *Uber*). Algorithmic explicit collusion may, however, pose evidentiary challenges. If algorithms prove to heavily increase tacit collusion and its corresponding negative economic effects, competition law may have to re-evaluate its permissive position towards this type of conduct. Among the types of potentially anti-competitive price coordination, restrictive or exploitative price differentiation between Swiss markets and EEA markets is particularly relevant to the Swiss economy.

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[62] Case C-74/14 *'Eturas' UAB and Others v. Lietuvos Respublikos konkurencijos taryba*, ECLI:EU:C:2016:42, n 45; Heinemann/Gebicka, fn (61), p. 440.
[63] Case C-74/14 *'Eturas' UAB and Others v. Lietuvos Respublikos konkurencijos taryba*, ECLI:EU:C:2016:42, n 45.
[64] Heinemann/Gebicka, fn (62), p. 440.
[65] See Heinemann/Gebicka, fn (62), p. 432.
[66] See Heinemann/Gebicka, fn (62), p. 440 et seq.

"Dynamic", deep-learning algorithms may, once they are broadly implemented, require an adjustment of competition law concepts such as causality, awareness (cf. *Eturas*), and intent. As a prerequisite for requesting changes in algorithmic market activity, competition law enforcement may, possibly, not have to show more than unwanted outcomes or correlations – for instance a failure of pricing algorithms to react to structural market changes resulting in potentially excessive prices (cf. *Lufthansa*). Further sanctions, however, may depend on (the degree of) human awareness or intent. Before adjusting its rules, however, law-makers and enforcers must gain a better understanding of how dynamic algorithms work. Furthermore, it would be helpful to consider the experience financial market regulation has already gained regarding algorithmic market activity.

On the consumer level, "digital agents" can be a helpful tool, not least in fending off algorithmic strategies which would harm consumers. At the same time, competition authorities, as well as consumers themselves, should try to ensure that digital butlers' algorithms are designed benevolently, that they are not employed in inappropriate areas, and that their use does not atrophy human decision-making power and independence.