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HORIZONTAL RESTRAINT REGULATIONS IN THE EU AND THE US IN THE ERA OF ALGORITHMIC TACIT COLLUSION

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Abstract: The fast development and improvement of e-commerce through various tools such as data mining, artificial intelligence and complex pricing algorithms has not gone unnoticed. Concerns about how new technologies can impact competition law have started to be raised by the academic world and various regulatory authorities. Specifically, the degree to which computer algorithms have the effect of inducing or enhancing tacit collusion is one of the most challenging topics for enforcement. Notwithstanding the question of whether algorithms should be *per se* regulated and how this can be achieved, in regard to tacit collusion scenarios enhanced by algorithms, we do have available tools that may be used to tackle it. This article will discuss whether the current regulation on horizontal restraints in the EU and the US could be appropriate for dealing with an algorithmic tacit collusion if such cases appear today.

'I think there is a world market for maybe five computers.'
Thomas Watson, president of IBM, 1943

A. INTRODUCTION

The fast development and improvement of e-commerce through various tools such as data mining, artificial intelligence and complex pricing algorithms has not gone unnoticed.[1] Concerns about how new technologies can impact competition law have started to be raised by academics and various regulatory authorities. Specifically, the degree to which computer algorithms have the effect of inducing or enhancing tacit collusion is one of the most challenging topics for enforcement.

To understand why e-commerce and its potential risks are relevant to competition law, we need to look at how the way we shop has changed due to the use of technology. In 2015, most countries had an Internet penetration of more than 50%,[2] when in 2005 it was only at 18%.[3] More and more people are accessing the web to buy a product that previously they may

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[1] Ariel Ezrachi and Maurice E Stucke, *Virtual Competition: The Promise and Perils of the Algorithm-Driven Economy* (Harvard University Press 2016) 1.

[2] Ecommerce Foundation, 'Global B2C E-Commerce Report 2016' (*Ecommerce Foundation,* December 2016) 17 <www.ecommercewiki.org/wikis/www.ecommercewiki.org/images/5/56/Global_B2C_Ecommerce_Report_2016.pdf> accessed 26 August 2017.

[3] International Communication Union, 'ICT Facts and Figures' (*International Telecommunications Union*, May 2015) < www.itu.int/en/ITU-D/Statistics/Documents/facts/ICTFactsFigures2015.pdf> accessed 30 August 2017.

have bought at a brick-and-mortar store. In 2016, e-commerce turnover had risen to USD$2,671 billion: a 17.5% increase compared to 2015.[4] Moreover, companies that have gone so far as to base all their activities in e-commerce have grown to the point of being major market powers: for example, in 2015 Amazon had more than USD$107 billion in revenue.[5] In this sense, these types of companies have created an entirely new market, the online market, with its own rules, risks and characteristics. This new market is built on technologies that are constantly evolving and that could cause problems that were once thought improbable, such as making tacit collusion more likely and easier to achieve.

The emergence of complex pricing algorithms is a key aspect of this technological revolution. Algorithms are essentially the bricks that have helped companies build their empires and that have allowed the development of the e-commerce field. For anyone who does not work in the IT field, it can be hard to grasp what an algorithm is, what it does, how it is structured and the potential it has. Nevertheless, an understanding of the challenges presented by the rising prominence of algorithms is likely to be vital to the legal profession in the coming years.

E-commerce and the use of algorithms bring in new challenges for policy makers in many areas,[6] and it can no longer be said that their effects on the market are a futuristic topic. As recently as 2015 the Department of Justice ('DOJ') gave a warning about the risks of algorithms for the market, consumers, and authorities.[7] Both the European Union ('EU') Commission and the American antitrust authorities have found it necessary to investigate the digital market. The recent fine imposed by the EU Commission in the Google case for abusing dominance as a search engine shows how relevant this market is.[8] Moreover, in the United States ('US') there has already been a case involving algorithms, which ended with the punishment of the members of a cartel of poster sellers on Amazon.[9] Thus, this novel field does

[4] Ecommerce Foundation (n 3) 9.
[5] Lina Khan, 'Amazon's Antitrust Paradox' (2017) 126 The Yale Law Journal 710.
[6] Kemal Derviş, 'The Regulatory Challenge of Disruptive Companies' (*World Economic Forum*, July 2015) < www.weforum.org/agenda/2015/07/the-regulatory-challenges-of-disruptive-companies/> accessed 31 July 2017.
[7] Ezrachi and Stucke (n 1) 39.
[8] European Commission, 'European Commision Press Release' (*EU Commission*, June 2017)<http://europa.eu/rapid/press-release_MEMO-17-1785_en.htm> accessed 31 August 2017.
[9] Department of Justice, 'Former E-Commerce Executive Charged with Price Fixing in the Antitrust Division's First Online Marketplace Prosecution' (*The United States Department of Justice*, April 2015) < www.justice.gov/opa/pr/former-e-commerce-executive-charged-price-fixing-antitrust-divisions-first-online-marketplace> accessed 31 August 2017.

not escape the reach of competition law. As Commissioner Vestager stated, firms could not ''hide behind computers'' and enforcers should watch over the advance of algorithms.[10]

Moreover, the Organisation for Economic Co-operation and Development ('OECD') has concentrated on technological developments and competition law. In November 2016, a Policy Roundtable on the use of Big Data was held,[11] and as recently as June 2017, there was another Policy Roundtable about algorithms and collusion.[12] Likewise, several competition agencies have also addressed this issue, as seen in their participation in the aforementioned OECD Roundtables. Scholars have also alerted of the dangers and have proposed possible solutions to the problems that might arise.[13]

There are several areas of antitrust that are directly affected by firms implementing algorithms in their processes, as can be seen in the Google case,[14] and the collusion of poster sellers on Amazon.[15] The use of algorithms has the potential to make collusive outcomes easier to achieve and more stable.[16] This may affect the entire spectrum of collusion scenarios, from the absolutely explicit to the completely tacit.[17] In an explicit collusion case, the firms agree on colluding and could use the algorithms to achieve or enhance this collusion, but the analysis of this scenario should not create major challenges for the authorities because it presupposes an agreement and therefore the already-existing regulation will be enough to prosecute it as a traditional cartel. The higher risks and enforcement challenges arise in the area of tacit collusion, which is an already-controversial topic, as will be explained further in this article.[18] The use of pricing algorithms could make tacit collusion more achievable and easier to sustain, but at the same time an algorithm implemented with innocent intent could result in entirely unintentional collusion, making prosecution difficult.

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[10] Margrethe Vestager, 'Algorithms and Competition' (*European Commission*, 2017) <https://ec.europa.eu/commission/commissioners/2014-2019/vestager/announcements/bundeskartellamt-18th-conference-competition-berlin-16-march-2017_en> accessed 21 August 2017.

[11] OECD, 'Big Data: Bringing Competition Policy to the Digital Era - Background Note by the Secretariat' (November 2016) Competition Policy Roundtable DAF/COMP(2016)14 <https://one.oecd.org/document/DAF/COMP(2016)14/en/pdf> accessed 5 March 2018 [OECD Big Data].

[12] OECD, 'Algorithms and Collusion: Competition Policy in the Digital Age', (June 2017) Competition Policy Roundtable <www.oecd.org/competition/algorithms-collusion-competition-policy-in-the-digital-age.htm> accessed 5 March 2018 [OECD Algorithms and Collusion]

[13] Ezrachi and Stucke (n 1).

[14] See the specific use of algorithms in European Commission, 'Fact Sheet (Case COMP/C-3/39.740)' [*EU Commission*, June 2017] <http://europa.eu/rapid/press-release_MEMO-17-1785_en.htm> accessed 29 August 2017.

[15] Department of Justice (n 9).

[16] OECD Algorithms and Collusion (n 12).

[17] Ezrachi and Stucke (n 1) 35.

[18] OECD Algorithms and Collusion (n 12) 33.

It remains to be seen if and how this new scenario should be regulated.[19] However, we do have available tools in the form of those regulations which deal with agreements between actual or potential competitors to restrain any aspect of their rivalry, more commonly known as horizontal restraints. This article will discuss whether the current regulations on horizontal restraints in the EU and in the US could be appropriate for dealing with an algorithmic tacit collusion. In Section B, I will explore how algorithms work and their impact as a potential enhancer of tacit collusion. Subsequently, in Section C, I will address the concept of tacit collusion and in Section D, I will address the interaction between algorithms and tacit collusion. Finally, in Section E, I will critically analyse how the substantive horizontal restraint rules both in the US and in the EU, as they are currently understood, could tackle the possible tacit collusion scenarios intensified by the use of pricing algorithms. Finally, this article will conclude that, despite the alarming voices, the existing regulations on horizontal agreements could be applied in a tacit collusion scenario, notwithstanding the recognised difficulties in doing so even in a non-algorithmic case.

B. ALGORITHMS: WHAT ARE THEY?

To begin with, it is necessary to understand algorithms.[20] An algorithm is a 'set of step by step instructions, to be carried out quite mechanically, so as to achieve some desired result'.[21] This definition is a simple answer to a difficult question, as elucidating what an algorithm is has proved to be a challenging problem.[22]

Algorithms are not new; they have been used by ancient cultures such as the Babylonians and Romans.[23] The word itself dates back to the ninth century and comes from the mathematician Al-Khwarizmi.[24] The concept of the algorithm has evolved through centuries; it went from being a mathematics concept related to any method of systematic calculation to today's understanding, which is closely linked to computer science.[25]

1. Basic concepts

[19] Ezrachi and Stucke (n 1) ch 18.
[20] Le Chen, Alan Mislove and Christo Wilson, 'An Empirical Analysis of Algorithmic Pricing on Amazon Marketplace' (2016), 2 <https://mislove.org/publications/Amazon-WWW.pdf> accessed 27 August 2017.
[21] Jean-Luc Chabert and E Barbin (eds), *A History of Algorithms: From the Pebble to the Microchip* (Springer 1999) 1.
[22] Yiannis Moschovakis, 'What Is an Algorithm?' in Björn Engquist and Wilfried Schmid (eds), *Mathematics unlimited: 2001 and beyond* (Springer 2001) 919.
[23] Chabert and Barbin (n 21) 1.
[24] ibid 2.
[25] ibid.

In computer science, an algorithm is 'any well-defined computational procedure that takes some value, or set of values, as input and produces some value, or sets of values, as output'.[26] Nowadays computer algorithms are used in almost all industries to improve efficiency in their processes, for example by measuring future results based on the analysis of historical data or reducing transaction costs.[27]

It is necessary to understand that all algorithms are, at their heart, essentially just very complicated decision trees.[28] Computer logic is binary, meaning all decisions made by a computer take the form 'IF x, THEN do y, ELSE do z'.[29] Despite this apparent simplicity, predicting the outcome of a given algorithm can be difficult, because the processing power of modern computers means that a computer is capable of making billions of such decisions each second, and all but the simplest algorithms make heavy use of recursive functions – that is to say, logical loops where the outcome of a step of the calculation is fed back into the same calculation repeatedly.[30] For a human being to 'follow along' with the logical steps that the algorithm is performing is therefore extremely difficult, and indeed most modern algorithms are written using tools that abstract away much of the low-level detail.[31] This abstraction, while essential to productivity, does mean that there is a substantial chance that not even the person who actually coded the algorithm in question will know exactly what results it will produce in every scenario.[32]

It is also necessary briefly to define some other concepts that are in widespread use as part of the functioning of many algorithms. Firstly, the term 'Big Data' is related to the collection, processing and exploitation of personal data for commercial use. Big Data can be defined as a dataset characterised by such a high volume, velocity and variety, that traditional data processors are not capable of processing it.[33] The use of Big Data can bring several benefits to consumers and the economy, notably in the area of finding patterns that traditional analysis would not identify.[34] 'Data Mining', which is a sub-concept of Big Data, can be explained as

[26] Thomas Cormen and others (eds), *Introduction to Algorithms* (3rd edn, MIT Press 2009) 6.
[27] OECD Algorithms and Collusion (n 12) 9.
[28] Rasoul Safavian and Dacid Landgrebe, 'A Survey of Decision Tree Classifier Methodology' (1991) 21 IEEE Transactions on Systems, Man, and Cybernetics 660, 660.
[29] John Cheney-Lippold, *We Are Data: Algorithms and the Making of Our Digital Selves* (New York University Press 2017) 179.
[30] JP Shim and others, 'Past, Present, and Future of Decision Support Technology' (2002) 33 Decision Support Systems 111, 111–113.
[31] Roy S Freedman, *Introduction to Financial Technology* (Elsevier 2006) 72.
[32] Ernst L Leiss, *A Programmer's Companion to Algorithm Analysis* (Chapman & Hall 2007) 109.
[33] A De Mauro, M Greco and M Grimaldi, 'A Formal Definition of Big Data Based on Its Essential Features' 65 Library Review 122, 131.
[34] For further analysis, see OECD Big Data (n 11).

'the automated or convenient extraction of patterns representing knowledge implicitly stored or captured in large databases, data warehouses, the web or other massive information repositories or data streams'.[35]

Another relevant concept is 'Artificial Intelligence' (AI) which is a branch of computer science that 'studies and designs an intelligent agent who should be able to carry out tasks of significant difficulty in a way that is perceived as intelligent.'[36] A subfield of AI is 'Machine Learning', which aims to grant computers the capacity to learn without having been programmed to do so.[37] Machine learning is very important for the use of Big Data as it allows going deeper into the information, in ways not necessarily originally imagined by the designer.[38]

These concepts seem futuristic, but they are not. Many companies have been using and developing these technologies and continue to do so.[39] For example, Walmart uses Big Data to improve operational efficiencies,[40] and Google uses the data it collects to develop new products and invests in deep learning and AI.[41]

2. Pricing algorithms

Algorithms can be used to create dynamic pricing tools, which are the focus of this paper. Dynamic pricing 'responds to market fluctuation in a real-time basis to achieve specific sale objectives such as maximize profit, maximize sales volume and minimize sales time'.[42] From a business perspective, for an e-commerce firm having a pricing algorithm is essential,[43] considering that they are already present in many areas of e-commerce[44] and that (freed from the limits of physical storefront space) e-commerce sellers are able to offer a far wider range of distinct products than was historically the case. In addition to using the seller's internal

[35] Jiawei Han and Micheline Kamber, *Data Mining: Concepts and Techniques* (3rd edn, Elsevier 2011) xxiii.
[36] OECD Algorithms and Collusion (n 12) 7.
[37] Phil Simon, *Too Big to Ignore: The Business Case for Big Data* (John Wiley & Sons, Inc 2013) 89.
[38] ibid.
[39] See Quora, 'What Companies Are Winning the Race for Artificial Intelligence?' (*Forbes,* February 2017) <www.forbes.com/sites/quora/2017/02/24/what-companies-are-winning-the-race-for-artificial-intelligence/#605fc06bf5cd> accessed 30 August 2017.
[40] OECD Big Data (n 11) 8.
[41] Bernard Barr, 'The Amazing Ways Google Uses Deep Learning AI' (*Forbes,* August 2017) <www.forbes.com/sites/bernardmarr/2017/08/08/the-amazing-ways-how-google-uses-deep-learning-ai/#6eacb9333204> accessed 27 August 2017.
[42] Samuel Hwang and Sungho Kim , 'Dynamic Pricing Algorithm for E-Commerce' in Tarek M Sobh and Khaled Elleithy (eds), *Advances in systems, computing sciences and software engineering: proceedings of SCSS 2005* (Springer 2006) 149.
[43] Ari Shpanya, 'Why Dynamic Pricing Is a Must for E-Commerce Retailers' (*Econsultancy*, August 2014) <https://econsultancy.com/blog/65327-why-dynamic-pricing-is-a-must-for-ecommerce-retailers#i.bme9vl12olcr6s> accessed 29 August 2017.
[44] Ezrachi and Stucke (n 1) 14.

information, pricing algorithms are used, *inter alia*, for collecting data from competitors, mainly their prices (but where possible, other information such as sales volumes, reported profits and so on), for then setting one's own price to maximise profit and/or sales.[45]

A pricing algorithm may seem an abstract concept, as the design varies from one to another; it could almost be said that there are infinite possible algorithms. For explanatory purposes, I will provide an example of a basic structure that will be useful to understand the legal analysis made in Section E. First, as contained in the definition, an algorithm needs input to produce an output. Simply put, the algorithms need to be fed with information in order to produce a result, in this case, a product's price. The information provided to the algorithm could be divided into internal input and external input, and this is where the concept of Big Data becomes useful. Internal input would be the seller's own information, for instance: i) its costs (fixed, variable, marginal, distribution, etc); ii) the desired profit margin; iii) willingness to forgo profit due to a foreseeable future loss (e.g. a sales season).

The external input is the information that the firm collects from the market. Examples of this could be: i) current information about competitors and customers such as price profile, currently known market prices, and customer information data; and ii) heuristic data[46] (information from past experiences that can be used for self-learning to predict future outcomes; for instance, the behaviour of the market the last time the price increased). External input would also include new governmental regulation that prohibits certain conduct or sets certain limits, which the algorithm could be set to take into account.

Having this input, the algorithm can be programmed to execute the functions desired by the firm, which in this example would be to collect data from the market, analyse it and set a price that would maximise the profits of the firm. The process herein described is of course an oversimplification compared to what a real-world algorithm would do, but it fulfils the purpose of explaining it. Having done so, it is necessary to introduce the legal framework and related economic concepts on which this article will focus.

C. TACIT COLLUSION

Both in the EU and in the US, the concept of collusion is associated with coordination by competitors to achieve supra-competitive benefits. In the EU, collusion is defined as 'actively conspiratorial behaviour of the kind captured by the expressions of agreement and concerted

[45] Hwang and Kim (n 42) 149.
[46] Judea Pearl, *Heuristics: Intelligent Search Strategies for Computer Problem Solving* (Addison-Wesley Pub Co 1984) 3.

practices of Article 101 Treaty on the Functioning of the European Union ('TFEU').'[47] In the US, collusion has been defined as the 'joint action to divide markets or fix prices, (...). Such collusive action is the substance of the conspiracy in restraint of trade which Section 1 of the [Sherman Act] makes a crime'.[48] Collusion can be explicit or tacit, as will be explained below.

Explicit collusion is achieved through an agreement (which itself can be explicit or tacit), and this agreement is a central matter to regulatory enforcement, either under article 101 TFEU[49] or Sherman Act §1.[50] Other notions included under these statutes are those of concerted practices in the EU, or conspiracy in the US.[51] Any of the aforementioned situations are straightforward in their enforcement. On the other hand, tacit collusion has been harder to define and enforce as it does not encompass an agreement, but generally arises from the interdependence associated with an oligopoly, and the enforcement of measures against it is ultimately a policy choice.[52]

1. The oligopoly problem

When discussing what tacit collusion is, it is necessary to address the oligopoly problem. An oligopoly is a market where few firms compete and the actions of each are considered by each other.[53] It is in this context where the oligopoly problem or the theory of oligopolistic interdependence appears.[54]

The oligopoly problem theory proposes that in an oligopolistic market, the competitors are interdependent. Interdependence in this setting means that the rivals are aware of each others' existence and adapt their strategies to achieve a stable non-competitive environment without the necessary incentives to compete.[55] The result of such behaviour is that, without the existence of an agreement between competitors, the competitive price that could exist is replaced by an oligopolistic price and thus supra-competitive profits.[56] However, this is not the only possible outcome, as firms in an oligopoly can be competitive,[57] a point discussed further in the second part of this Section.

[47] Richard Whish and David Bailey, *Competition Law* (8th edn, OUP 2015) 594.
[48] Carl Kaysen, 'Collusion under Sherman Act 1' (1951) 65 *The Quarterly Journal of Economics* 263, 263.
[49] Consolidated Version of Treaty on the Functioning of the European Union 2012 (C 326/47) Article 101.
[50] Sherman Act, 15 U.S.C§ 1 (1890).
[51] Einer Elhauge and Damien Geradin, *Global Competition Law and Economics* (Bloomsbury 2011) 807.
[52] Ezrachi and Stucke (n 1) 203.
[53] Alan Devlin, *Fundamental Principles of Law and Economics* (Routledge 2015) 338.
[54] Whish and Bailey (n 47) 595.
[55] ibid 596.
[56] ibid 595.
[57] Sigrid Stroux, *US and EC Oligopoly Control* (Kluwer Law International 2004) 1.

There are certain conditions for tacit coordination to emerge. Firstly, firms need to have the capacity to monitor competitors and the ‘‘parameters that lend themselves to being a focal point of the proposed coordination’’ (such as pricing or output levels);[58] and this is why price transparency enhanced by algorithms plays a relevant role, as will be discussed later. Then, to incentivise firms to continue adhering to the coordinated position, there has to be a ‘deterrent punishment mechanism which requires that the detected cheats could be sanctioned both credibly and effectively’.[59] Such punishment could be, for example, going back to competitive prices.

The pricing system in an oligopolistic market ‘can be described as a rational individual decision in light of the relevant economic facts’.[60] As can be seen, the outcome of interdependence is similar to the one that could be achieved with explicit collusion and it should be equally undesired. Economists refer to the result of the oligopoly problem as tacit collusion, whereas lawyers refer to it as conscious parallelism.[61] There are also other (roughly synonymous) concepts used in this regard, such as parallel conduct, parallel pricing, oligopolistic pricing suits, implicit collusion, imperfect cartels, non-cooperative collusion, tacit coordination, coordinated effects, or self-enforcing collusion.[62]

From an economic perspective, the outcome of oligopoly can be explained through game theory, as firms play ‘repeated games’.[63] This means that the players can analyse previous games to make their future decisions, which translates into studying the previous pricing strategies of the competing firms to make the next pricing decision.[64] However, for maintaining tacit collusion, the information has to be complete and perfect[65] (and as will be seen, this is where algorithms that aid in the completeness and perfection of the information become problematic).

The factors that facilitate the occurrence of tacit collusion can be either structural or not.[66] The structural factors are, *inter alia*, concentration, entry, cross-ownership and other links among competitors, regularity and frequency of orders, buyers’ power, demand elasticity,

[58] Case C-413/06 P *Bertlesmann AG and Sony Corporation of America v Impala* ECR 2008 -04951 [123].
[59] Florian Wagner-von Papp, ‘Information Exchanges Agreements’ in Ioannis Lianos and Damien Geradin (eds), *Handbook on European Competition Law Substantive aspects* (Elgar 2013) 138.
[60] Donald Turner, ‘The Definition of Agreement under the Sherman Act: Conscious Parallelism and Resfusals to Deal’ (1962) 75 Harvard Law Review 655, 666.
[61] Whish and Bailey (n 54) 597.
[62] Nicolas Petit, ‘The “Oligopoly Problem” in EU Competition Law’ in Ioannis Lianos and Damien Geradin (eds), *Handbook on European Competition Law Substantive aspects* (Edward Elgar 2013) 284.
[63] Stroux (n 57) 15.
[64] ibid 16.
[65] Wagner-von Papp (n 59) 143.
[66] Massimo Motta, *Competition Policy: Theory and Practice* (Cambridge University Press 2004) 142.

the evolution of demand, product homogeneity, symmetry, multi-market contacts, inventories and excess capacities. The non-structural factors are price transparency and exchange of information.[67]

2. The legal challenge of tacit collusion

The oligopoly problem poses the following question: should tacit collusion be prevented or subjected to enforcement action even if it is rational conduct of a firm in an oligopolistic market? Tacit collusion has not been an uncontroversial subject among scholars, nor in the courts, both in the EU and in the US, as explained below. The challenge resides in the fact that there is a gap in the regulation of horizontal restraints, because what such regulation prohibits are agreements or concertation, and in the case of tacit collusion, such agreement does not exist. Introducing algorithms in this already controversial topic will relight this discussion, as they make the risks of tacit collusion more likely to occur.

The legality of tacit collusion[68] has been discussed by scholars and a common understanding on the matter has yet to be reached. Donald Turner analysed whether conscious parallelism could be considered an agreement regulated under §1 of the Sherman Act. His view on the matter was that 'conscious parallelism is devoid of anything that might reasonably be called agreement when it involves simply the independent responses of a group of competitors to the same set of economic facts - independent in the sense that each would have made the same decision for himself even though his competitors decided otherwise'.[69] An oligopolistic firm takes into consideration the reaction of the other firms in the market to any price adjustment that it executes since the other firms will surely react because of the potential loss in their sales.[70]

By contrast, Richard Posner argued that a firm might initiate a reduction of the price because of the time lag between such reduction and the response by the other oligopolistic firms, in which case there is a possibility that the price reduction could be profitable until it is matched, which could be understood to be a economically rational conduct.[71] Thus, it can be understood from the absence of such reductions in an oligopoly that there is an effort to jointly

[67] Marc Ivaldu and others, 'The Economics of Tacit Collusion, Final Report for DG Competition (*European Commission,* March 2013) <http://ec.europa.eu/competition/mergers/studies_reports/the_economics_of_tacit_collusion_en.pdf> accessed 5 March 2018.
[68] Please note that the expression 'conscious parallelism' will also be used here as the legal scholars' equivalent to 'tacit collusion'.
[69] Turner (n 60) 665.
[70] ibid.
[71] Richard A Posner, *Antitrust Law* (2nd edn, University of Chicago Press 2001) 57.

maximise the price. Nevertheless, Turner concluded that if firms in an oligopolistic market consider the probable conduct of their competitors when establishing their prices 'without more in the way of agreement than is found in conscious parallelism, [they] should not be held unlawful conspirators under the Sherman Act'.[72] Posner disputed such an approach, considering it inadequate.[73] He proposed an economic approach to collusion, either tacit or explicit.[74] If there is enough economic evidence to infer collusive pricing, 'there is neither legal nor practical justification for requiring evidence that will support the further inference that the collusion was explicit rather than tacit'.[75] Thus, Posner argued that tacit collusion should be analysed as a tacit meeting of minds,[76] to which the Sherman Act would be applicable.

Kaplow provides a more organic analysis of the concept of tacit collusion by giving a different classification and re-categorisation of the interaction among firms.[77] He starts by making a clear-cut distinction between independent behaviour,[78] interdependent behaviour[79] and express agreement, and notes that these terms may lead to confusion when they are not well-defined.[80] Under this view, the concept of plain interdependence falls within the idea of 'agreement',[81] and is therefore subject to enforcement action under § 1 of the Sherman Act. However, he recognises that there should be a balance between the deterrence of misconduct and the 'chilling of desirable economic activity'.[82] Lastly, writing in relation to the EU regime, Petit is of the view that 'the fact that tacit collusion is rational conduct cannot, and should not, be a cause for excuse under the competition rules'.[83]

Finally, in the context of these debates as to the appropriate regulatory response to oligopoly, it should be noted that even if tacit collusion appears to be a very probable outcome in an oligopolistic market, there are some caveats. Firstly, a collusive outcome arising from pure interdependence is unlikely to occur, as in real life markets there are other variables to consider such as product differentiation, lack of information about competitors (which could

[72] Turner (n 60) 671.
[73] Posner (n 71) 57.
[74] ibid 69.
[75] ibid 94.
[76] ibid 95.
[77] Louis Kaplow, 'On the Meaning of Horizontal Agreements in Competition Law' (2011) Harvard Law and Economics Discussion Paper No 691 <https://ssrn.com/abstract=1873430> or <http://dx.doi.org/10.2139/ssrn.1873430> accessed 5 March 2018.
[78] Independent behaviour can be defined as 'behavior by two or more parties that has no relationship whatsoever as well as behavior that has similarities yet is motivated by considerations that do not depend on others' reactions.'
[79] Interdependent behaviour can be defined as: 'behaviour that involves coordination with others'.
[80] Kaplow (n 77) 16.
[81] ibid 96.
[82] ibid 113.
[83] Petit (n 62) 22.

incentivise cheating) and potential new entrants.[84] Second is the fact that many oligopolistic markets are competitive, not only in terms of price competition, but also non-price competition, such as after-sales services, quality of products and loyalty schemes.[85] Moreover, Motta argues that in a tacit collusion scenario it would be difficult for firms to effectively coordinate as they 'cannot communicate with each other, they can make mistakes, and select a price (or quantity) which is not jointly optimal for the firms.'[86] The result of trying to coordinate without communication could be too expensive[87] and may affect the willingness of the firms to participate in the collusive outcome.

As can be seen, the theory of oligopoly interdependence is a controversial topic among economists and lawyers, who have different positions on whether such interdependence should of itself provide a basis for enforcement action.[88] The trend in Courts both in the US and in the EU has been not to condemn conscious parallelism as illegal in an oligopolistic market unless it can be proved that there was an agreement.[89]

D. HOW COULD ALGORITHMS CHANGE TACIT COLLUSION?

The discussion of oligopoly interdependence may take a new approach when algorithms are put in the picture. Even if tacit collusion, in theory, is a possible outcome in an oligopolistic market, in practice it is unlikely to occur, for the reasons discussed in Section C.[90] As noted by Stucke and Ezrachi, algorithms could create a so-called 'tacit collusion on steroids' scenario.[91] The reason to assert this is that 'industry-wide use of pricing algorithms leads to higher prices, without any clear or implied human anticompetitive agreement.'[92] The use of pricing algorithms could make tacit collusion more common in the already oligopolistic markets and even extend 'the oligopoly problem to non-oligopolistic markets structures'.[93] In particular, pricing algorithms allow: i) greater speed in detection of and reaction to competitor price movements; ii) improved accuracy in such detection and reaction (since algorithms will be

[84] William Page, 'Communication and Concerted Action' (2007) 38 Loyola University Chicago Law Journal 405.
[85] Whish and Bailey (n 47) 600.
[86] Motta (n 66) 141.
[87] ibid.
[88] Paolo Siciliani, 'Should We Act Ex Post Against Tacit Collusion—and How?' (2014) 5 J*ournal of* European Competition Law & Practice 295.
[89] Page (n 84) 409; OECD, 'Policy Roundtable - Facilitating Practices in Oligopolies' (2008) Competition Policy Roundtable DAF/COMP(2008)24 <https://www.oecd.org/daf/competition/41472165.pdf> accessed 8 March 2018 [OECD Facilitating Practices].
[90] OECD Algorithms and Collusion (n 12) 34.
[91] Ezrachi and Stucke (n 1) 56.
[92] ibid.
[93] OECD Algorithms and Collusion (n 12) 35.

more efficient in studying the price fluctuations and the probabilities of deviation); and iii) minimization of human factors (the removal of human decision-making from the pricing strategy may lead to more stable cartels, because of the better understanding of the market that algorithms might have).[94]

Algorithms may also have procompetitive effects that are connected with the efficiencies both in the supply side and the demand side.[95] For example, on the supply side, algorithms improve transparency in the market.[96] Nevertheless, this factor could also lead to collusion in markets with limited players.[97] Transparency of prices is a 'double edged sword',[98] and the overall effect of the transparency should be measured on a case by case basis, to determine if this attribute is a benefit or not. With pricing algorithms firms have more information about market trends and can better assess the optimal price level and change it accordingly.[99] This has the effect of levelling the playing field for smaller companies to directly compete with firms that may have more resources for such purpose. On the other hand, it could be argued that this feature may render tacit collusion more feasible, due to the enhanced capacity of firms to rapidly adjust to the price changes of competitors. The critique Posner made to Turner's approach to tacit collusion was based on the time it took firms to change their prices. If a firm reduces its prices, the other competitors could be able to match such price reduction much faster if they use algorithms, reducing the firm's incentive to undertake a price reduction strategy.[100] The Posner approach to tacit collusion would not therefore be applicable to an environment where algorithms are used to implement a pricing strategy, especially when they are programmed to maximise profits, as there would not be a time lag in which the price cut could be profitable given that the price matching by the other firms might be immediate.

The way in which algorithms are set to function, and the capacity they have to process information and change the data (prices) provided to the market, are practically unlimited. There are many ways in which in the data collection phase can be carried out depending on how easy it is to access the information of the competitor. For example, when a 'robot' (i.e. the

[94] ibid.
[95] ibid 12.
[96] ibid.
[97] Ariel Ezrachi and Maurice E Stucke, 'Algorithmic Collusion: Problems and Counter-Measures'(June 2017) Roundtable on Algorithms and Collusion DAF/COMP/WD(2017)25 5 <https://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=DAF/COMP/WD%282017%2925&docLanguage=En> accessed 8 March 2018.
[98] Mario Monti, 'Speech by Mr. Mario Monti - Defining the Boundries Competition Policy in High Tech Sectors' SPEECH/01/375 (*EU Commision,* 2001) 2 <http://europa.eu/rapid/press-release_SPEECH-01-375_en.pdf> accessed 29 August 2017.
[99] Shpanya (n 44).
[100] Ezrachi and Stucke (n 1) 63.

automated piece of software that is tasked with fetching the prices) of firm A looks for the prices of firm B, the robot may have access to a specifically-published data web service provided by firm B (firm A would need to be subscribed to it, and firm B would need to allow this), or the algorithm could carry out a data scraping function,[101] which is much more complicated, but which can be done without firm B's knowledge or consent. Firm B could however take measures to prevent easy access to its prices, even if they are posted online. Accordingly, from the way data is collected, firm B's attitude towards competition may be inferred, depending on the technique used to extract data. If firm B allows firm A to subscribe to its data web services, and therefore get instant access to price information, it could be thought that firm B is deliberately exchanging sensitive information with firm A through an algorithm, the implications of which will be discussed later in this piece.

Other factors worth considering are: how often the algorithm of firm A is programmed to collect data, and how fast the pricing decision is made. In this sense, the frequency in which firms obtain information from their competitors may have effects in the market as stated by the Finnish competition agency in regard to the ScanTrack service offered by AC Nielsen.[102] Many features of an algorithm should be studied and tested to understand the real effect it may have on the market and to qualify it as competitive or anticompetitive.

High quality input data is fundamental for a pricing algorithm to be effective.[103] Thus, the capacity to collect consumer and market information is very relevant, as this is what makes it possible for firms to effectively use algorithms as pricing tools.[104] However, it is argued that in determining how the algorithm finally sets the price to be charged to consumers, the firm should avoid programming algorithms that could (for example by introducing too-frequent price changes, by gathering the information in a method designed to ensure that competitors are working from the same data set, or by having any other feature from which anticompetitive intent could be understood) eventually lead to tacit collusion. Nonetheless, it would be possible to argue that in programming an algorithm, there are many actions that could be taken to avoid creating a potential collusion scenario and still maintain the benefits of using it due to the

[101] Jeffrey Hirschey, 'Symbiotic Relationships: Pragmatic Acceptance of Data Scraping' (2014) 29 Berkeley Techology Law Journal 897.
[102] OECD, 'Information Exchanges between Competitors under Competition Law', (July 2011) Competition Policy Roundtable DAF/COMP(2010)37 165 < http://www.oecd.org/competition/cartels/48379006.pdf> accessed 8 March 2018.
[103] Hwang and Kim (n 42) 150.
[104] Salil Mehra, 'Antitrust and the Robo-Seller: Competition in the Time of Algorithms' (2016) 100 Minnesota Law Review 1337.

efficiencies it can bring to the market. Thus, understanding how algorithms work is crucial both to analyse the risks and the benefits and to adequately assess them.

Algorithms could thus have a huge impact in tacit collusion. However, for this to occur, it has to be assumed that the algorithms are programmed to work with similar parameters and achieve a common aim of maximising profit, and even in that case, outcomes could be variable, due to chaos theory, in the sense that tiny changes in the starting conditions can lead to massive differences in outcomes.[105] Moreover, the use of algorithms also has an impact on price discrimination, which could be thought of as a limit to tacit collusion.[106] Nevertheless, in theory under certain assumptions pricing algorithms could lead to a tacit collusion outcome more easily by ''facilitating a non-competitive equilibrium by working as instruments that eliminate the need for explicit communication or interaction between competitors''.[107] Thus, the optimal use of pricing algorithms could be an effective means of effecting tacit collusion.[108]

E. HORIZONTAL RESTRAINT REGULATIONS: HOW COULD THEY BE APPLIED IN A TACIT COLLUSION SCENARIO EXACERBATED BY ALGORITHMS?

Since algorithms are already present in the economy, and thus it is possible to encounter a tacit collusion scenario enhanced by algorithms, I will now discuss how the existing regulations on horizontal restraints could be applied in such a case and whether it would be necessary to introduce any other regulatory alternative. If there were a case now involving algorithms and tacit collusion, how could Article 101 TFEU and §1 of the Sherman Act be applied?

In the bigger picture, there are two questions to answer regarding the regulation of algorithms and collusion: first, whether the use of algorithms should be regulated from a competition law perspective; and second, what tools could be used for such purposes. I consider that the regulation challenge in this topic is twofold. On one hand, the existing gap in the regulation of tacit collusion could make it more difficult to enforce a pure case of tacit collusion aided by algorithms. On the other hand, the consequences of pricing algorithms are still not yet well understood[109] (nor are they likely ever to be in full), and it is a field where innovation is of the essence; furthermore, competition authorities do not have sufficient knowledge on

[105] Christos Skiadas and Charilaos Skiadas, *Handbook of Applications of Chaos Theory* (CRC Press 2016) 228.
[106] For a detailed explanation of this point see Ezrachi and Stucke (n 97) 12.
[107] OECD Big Data (n 11) 35.
[108] Bruno Salcedo, 'Pricing Algorithms and Tacit Collusion' (*Bruno Salcedo,* January 2016) 20 <http://www.brunosalcedo.com/docs/collusion.pdf> accessed 20 March 2018.
[109] Chen, Mislove and Wilson (n 20) 10.

algorithms.[110] However, these challenges to regulation should not be considered as an insurmountable impediment for competition authorities. The existing regulation on horizontal agreements could be applicable, in conjunction with the facilitating practices or plus factors doctrine, which will be further explained.[111] Before considering other possible tools, such as auditing algorithms[112] or creating new laws, the ones already available should be given a chance. Moreover, regulations affecting related areas of innovation could indirectly affect the topic of tacit collusion. For example privacy and other laws governing the handling of Big Data will be particularly relevant to the collection and use of the data on which the effectiveness of algorithms depends.

Before describing the enforcement options under the current horizontal regulations in the EU and in the US to tackle an undesired outcome, it should be reiterated that, as explained earlier, algorithms have different designs and purposes and can work in very diverse ways. Additionally, it is a fast-evolving area. Studying algorithms could be very complex due to the dynamism of the area and the constant development of new technologies. For example, AI, the evolution of Big Data and deep learning could render obsolete any potential regulation within a short period of time.

This issue of fast evolution is particularly relevant in relation to the e-commerce market. The dynamism in the market has been previously considered by competition authorities when studying a market. For example, when Microsoft bought Skype, the EU Commission took this factor into account when it approved the transaction.[113] However, the EU Commission has also investigated situations where there was anticompetitive conduct in a dynamic market: examples of this are the Microsoft v. Commission case and the AstraZeneca v. Commission case.[114] In this regard, some argue that courts and agencies should rarely, if ever, intervene in dynamic industries.[115] Innovation should be considered a factor that encourages firms to compete more intensely, due to the rewards that they can attain.[116]

As can be seen, the challenge to regulate algorithms is not minor, and companies are adopting business models that rely on algorithms either for data collection, data analysis or

[110] ibid 2.
[111] Antonio Capobianco and Pedro Gonzaga, 'Algorithms and Competition: Friends or Foes?' (*Competition and Policy International* August 2017) <https://www.competitionpolicyinternational.com/wp-content/uploads/2017/08/CPI-Capobianco-Gonzaga.pdf> accessed 22 August 2017.
[112] Ezrachi and Stucke (n 1) 230.
[113] ibid 25.
[114] Jonathan Galloway, 'Driving Innovation: A Case for Targeted Competition Policy in Dynamic Markets' (2011) 34 World Competition 73, 1.
[115] Ezrachi and Stucke (n 1) 25.
[116] Galloway (n 122) 1.

pricing purposes.[117] However, that does not mean it is impossible. The extensive use of pricing algorithms could clearly make coordination easier, cheaper and faster, and thus lead to more cases of tacit collusion. Even now, with the existing tools and regulations, it could be possible to tackle in some way these effects.[118]

3. The notion of agreement under Article 101 TFEU and §1 of the Sherman Act

From the enforcement perspective, as noted previously tacit collusion is considered a gap because the illegality of collusion depends on the existence of an agreement (or concerted practice, as discussed in the next sub-section below).[119] In enforcement proceedings relating to explicit collusion, the authorities will usually be able to establish the existence of an agreement or a concerted practice, and therefore the application of Article 101 TFEU or §1 of the Sherman Act is very straightforward. By contrast, and even if criticised,[120] it has been recognised by courts both in the US and in the EU that tacit collusion (understood as conscious parallelism), is not *per se* unlawful.[121] Thus, one would think that the first option for enforcing tacit collusion enhanced by the use of pricing algorithms would be to revisit the concept of agreement or concerted practice.[122]

When addressing agreements, there is a very relevant evidentiary factor to consider.[123] Much has been discussed on what qualifies as an agreement and how it has to be proven.[124] When dealing with oligopolies, it has been difficult for competition authorities to set the adequate evidentiary standard for proving an agreement, especially in cases of conscious parallelism, as it is not assumed that it is a concerted action.[125]

In the EU, Article 101 includes both agreements and concerted practices. A (price-fixing) agreement 'centres around the existence of a concurrence of wills between at least two parties, the form in which it is manifested being unimportant so long as it constitutes the faithful expression of the parties' intention.'[126] Concerted practice is 'a form of coordination between undertakings which, without having reached the stage where an agreement properly so-called has been concluded, knowingly substitutes practical cooperation between them for the risks of

[117] Ezrachi and Stucke (n 1) 20.
[118] OECD Algorithms and Collusion (n 12); Vestager (n 11).
[119] OECD Algorithms and Collusion (n 12) 34.
[120] Posner (n 71).
[121] Page (n 84) 408; Whish and Bailey (n 47) 603.
[122] OECD Algorithms and Collusion (n 12) 35. Please note that in the US the term used is 'concerted action'.
[123] Ernest Gellhorn, William E Kovacic and Stephen Calkins, *Antitrust Law and Economics in a Nutshell* (5th edn, Thomson/West 2004) 269.
[124] Elhauge and Geradin (n 51) 842; Whish and Bailey (n 47) 104.
[125] William Kovacic and others, 'Plus Factors and Agreement in Antitrust Law' (2011) 110 Michigan Law Review 395.
[126] Case T-41/96 *Bayer v Commission* [2000] ECR II-3383 [69].

competition'.[127] This criterion has been applied in other cases, such as in the *Suiker Unie v. Commission*.[128] Even if agreements and concerted practices are conceptually diverse, there is no need to set a point on which one ends and the other one starts.[129]

In the US, the concept of agreement and concerted action are employed interchangeably as constituting a joint action prohibited by §1 of the Sherman Act.[130] The concept of agreement does not explicitly appear in §1 of the Sherman Act, as it uses the terms contract, combination and conspiracy.[131] These three concepts encompass a single term[132] which is one of 'agreement' with an anticompetitive purpose.[133] In the *Socony* case,[134] the Supreme Court precluded all types of price-fixing agreements, including as such any combination or conspiracy to fix prices. The concept of concerted action is also covered by the Sherman Act,[135] as can be seen in the the *Container Corp* case.[136] Thus, both in the EU and the US, the requirement for an agreement to be found is the concurrence of wills, and in the case of tacit collusion, that requirement is not satisfied.

It is thus clear that tacit collusion is not included in the pure concept of agreement. Posner and Kaplow have advocated for this to change, suggesting that oligopolistic behaviour encompasses an understanding with other competitors, as explained in Section C. The reason for not including tacit collusion in the concept of agreement may be the risk of chilling competition by over-deterring conduct that could be the result of normal business behaviour, as stated above. Nevertheless, revising the notion of 'agreement' (whether by legislative change or further development in the interpretation of existing rules) could be a possibility to expand the concept's scope as predicated by Posner and Kaplow,[137] so tacit collusion could be prevented by enforcement. The difference now, which raises concern, is that algorithms could make tacit collusion more effective and plausible in oligopolistic markets, and even feasible in non-oligopolistic markets. As algorithms theoretically increase the risk of collusion, it may occur more frequently, and therefore, amending the current regulation on horizontal restraints

[127] Case 48-69 *ICI v Commission* [1972] ECR 619 [64].
[128] Joined cases 40 to 48, 50, 54 to 56, 111, 113 and 114-7 *Suiker Unie and others v Commission* (1975) ECR 01663.
[129] Whish and Bailey (n 47) 106.
[130] Elhauge and Geradin (n 51) 842.
[131] Kaplow (n 77) 18.
[132] Phillip Areeda and Herbert Hovenkamp, *Fundamentals of Antitrust Law* (4th edn, Wolters Kluwer Law & Business 2011) s 14.01.
[133] Kaplow (n 77) 37.
[134] *United States v Socony-Vacuum Oil* 310 US 150 1940.
[135] Gellhorn, Kovacic and Calkins (n 123) 268.
[136] *United States v Container Corp* 393 US 333 1969.
[137] See Section C above.

may be an option, but the benefits and risks should be carefully analysed to avoid undesired effects, such as deterring competitive conduct.

It should be noted that in accordance with the EU Guidelines on Horizontal Cooperation[138] exchanges of information between competitors (including pricing information) could be tackled under Article 101 TFEU, if there is an agreement or concerted practice to exchange such information.[139] The theory of harm of such information exchanges is that they facilitate the occurrence of tacit collusion in markets where the existing transparency of prices as between competitors would otherwise be insufficient to maintain tacit collusion.[140] As argued by Wagner-von Papp, the impact of information exchanges is better understood through game theory.[141] The underlying argument is that in an oligopoly, the main challenge to the oligopolists is that there is no complete information about the game, and exchanging information helps overcome this challenge.[142] However, as it remains necessary to prove an agreement or concerted practice in such a tacit collusion case, we fall into the same problem addressed above about the difficulties of enforcing in respect of other forms of tacit collusion. The possible exception to this would be scenarios where one player in a market takes active steps to deliberately share its pricing information with a direct competitor, which may in itself be seen as an intentionally anticompetitive step.

4. Concerted practices and plus factors in general

The question to be answered now is whether parallel behaviour can be identified with a concerted practice or not. In the EU, the European Court of Justice ('ECJ') set forth in the *Dyestuff* case[143] that 'although parallel behaviour may not in itself be identified with a concerted practice, it may however, amount to strong evidence of such practice … '.[144] Since then, and until the case *Woodpulp II*,[145] the ECJ was reluctant to accept the possibility that Article 101 TFEU was applicable to tacit collusion,[146] as seen in other cases such as the *Züchner* case[147] and the *Zinc Producers* case.[148] This approach was later revised in *Woodpulp*

[138] Communication from the Commission, Guidelines on the applicability of Article 101 of the Treaty on the Functioning of the European Union to horizontal co-operation agreements[2011] OJ C 11/01.
[139] Whish and Bailey (n 47) 577.
[140] Wagner-von Papp (n 59) 138.
[141] See details at ibid.
[142] ibid 140.
[143] *ICI v Commission* (n 135).
[144] Whish and Bailey (n 47) 603.
[145] Joined cases C-89/85, C-104/85, C-116/85, C-117/85 and C-129/85 *Ahlstrom Osakeyhtio and others v Commision* [1993] ECR -307.
[146] Petit (n 62) 289.
[147] Case 172/80 *Züchner v Bayeriche Vereinbank* [1981] ECR 2021 [14].
[148] *Zinc Producer Group* (Case IV/30.350) Commission Decision 84/405/EEC [1984] OJ L220/27.

II, which marked a departure from the previous case law as it did not exclude the possibility that Article 101 could be applicable to tacit collusion.[149] This was later confirmed in the *CISAC* case in 2013.[150] The result of these cases, as mentioned by Stroux, was that concerted practice could be 'inferred from parallelism of behaviour if it is the only plausible explanation for it.'[151]

In the US, so far courts have set the limit between conscious parallelism and unlawful concerted action by means of common law development, as the Sherman Act provides no guidance on this matter.[152] In the *Brooke Group* case, the Supreme Court provided that tacit collusion (understood as conscious parallelism) ''describes the process, in itself not unlawful, by which firms in a concentrated market might in effect share monopoly power, setting their prices at a profit-maximizing, supracompetitive level by recognizing their shared economic interests and their interdependence with respect to price and output decisions''.[153]

It has been held that conscious parallelism could be a violation of §1 of the Sherman Act, if additional evidence consistent only with a concerted action scenario is provided, such evidence comprising the so-called 'plus factors'.[154] Thus, the plus factors doctrine is used in the US for the prosecution of certain types of parallel conduct and can be defined as 'the body of economic circumstantial evidence of collusion, and beyond parallel movement of prices by firm in an industry'.[155] They are operational criteria by which courts allow an agreement to be proved by circumstantial evidence, beyond merely the economic evidence of parallel pricing behaviour.[156] Stroux classifies plus factors in five categories, and for the analysis of parallelism and algorithms, the relevant ones are the factual, the economic and the facilitating practice plus factors.[157] However, even with the existing judicial experience and the contributions that lawyers and economists have made to this area, the proof of concerted action remains a disputed topic in cases under§1 of the Sherman Act.[158]

On the other hand, in the EU, the plus factors approach is not present in the case law. However, after the *Woodpulp II* case, it could be said that a threshold was set and that compared to the US, it is lower as American courts require proving the plus factors.[159]

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[149] Petit (n 62) 291.
[150] Case T-442/08 *CISAC v Commission* [2013] [2013] 5 CMLR 15.
[151] Stroux (n 57) 80.
[152] Page (n 84) 410.
[153] *Brooke Group v Brown &Williamson Tobacco* [1993] 509 US 209 227.
[154] Page (n 84) 414.
[155] Robert C Marshall and Leslie M Marx, *The Economics of Collusion: Cartels and Bidding Rings* (MIT Press 2012) 213.
[156] Kovacic and others (n 125) 395.
[157] Stroux (n 57) 51.
[158] Kovacic and others (n 125) 399.
[159] Stroux (n 57) 80.

5. Algorithms as plus factors or facilitating practices

An agreement or concerted practice is thus pivotal for the triggering of the horizontal restraint rules, both in the US and the EU. As has been seen, this formalistic approach (focusing on the existence of an agreement rather than the outcome) does not include a situation where competitors engage in parallel conduct unless it complies with the evidentiary requirements above described. However just as the involvement of algorithms may increase the risk of tacit collusion, it may also provide additional grounds for enforcement action, which will now be considered.

a) Algorithms as plus factors

When faced with tacit collusion involving algorithms, it could be considered that having a pricing algorithm with certain characteristics could be treated as a plus factor, that helps to achieve a parallel outcome. Notwithstanding that the universe of types of algorithms is almost infinite, there are a variety of algorithmic patterns that can be identified as aiding tacit collusion. Comparison could be drawn with certain pricing systems which have been considered as potential enhancers of tacit collusion in several cases, and have been treated as plus factors.[160] In the *General Electric and Westinghouse* case (which ended with a settlement), the DOJ stated that even if there was no evidence proving that there was some sort of communication between the companies, 'the independent yet parallel adoption of the new policy by GE and Westinghouse had brought about a meeting of the minds and facilitated the elimination of price competition'.[161] In *Wall Products v. National Gypsum*, a private enforcement case, the court found that the firms involved 'combined and conspired among themselves and others to stabilise and maintain the price level of Gypsum wallboard through a course of interdependent conscious parallel action pursuant to a tacit understanding by acquiescence coupled with assistance, whereby they mutually agreed [...].'[162]

Taking a pricing system called the posted prices system[163] as an example of a plus factor, Harrington evaluates four variables: i) whether before adopting a posted pricing system, the prices were below any publicly announced list, or did not have a publicly announced list price; ii) whether having this system only serves the interest of the firm if the competitors adopt the same strategy; iii) whether after implementing the new pricing strategy, the prices are higher and more uniform; and iv) whether there are market conditions that make collusion

[160] Joseph E Harrington Jr., 'Posted Princing as a plus Factor' (2011) 7 Journal of Competition Law & Economics 1; Stroux (n 57) 52.
[161] Harrington Jr (n 160) 5.
[162] 357 F Supp 832 (ND Cal 1973).
[163] Public announcement by firms of a policy to set a list price with no discounting off of that list price.

feasible.[164] This evaluation focuses on 'identifying circumstances under which the adoption of posted pricing is the basis for inferring that firms have entered into an agreement to coordinate their prices'.[165]

The decision to adopt an algorithm could be scrutinised through the same lens: competition authorities should study the pricing situation from an economic perspective before having algorithms (for industries that are also present in the brick-and-mortar market), or the situation before the competitor entered into the e-commerce market (for firms that have always been e-commerce ones, like Amazon). Moreover, it should be examined whether the algorithmic maximising profit function is only effective if other firms take the same action, and discard other pricing strategies such as price discrimination or discounts, and it is critical to understand 'if some practice is only in a firm's best interest when it anticipates coordinated pricing'.[166] To conclude whether the conduct in question amounts to an unlawful concerted practice, it is necessary to consider the economic analysis of the case.

Another element to be assessed as a plus factor is the exchange of information. It is important to consider the input of the algorithm, as it is fed with already-existing information, either internal or external. The way in which data collection is carried out is of vital importance. The access that a firm can give to another firm through data web services could be a sign of willingness to enter into tacit collusion. There are various safeguards that firms could take in order to prevent a competitor's robot or web crawler from collecting price data effectively, and a company with competitive intent would usually be expected to attempt to use these safeguards so as to gain a favourable position of informational asymmetry (gaining competitive advantage through being better-informed).

It is for this reason that I am proposing that failing to implement such safeguards should be considered a plus factor. This may be extending the concept of exchange of information, but what firms are doing by allowing other firms to know their prices and feed them into their own pricing algorithms is exactly that. The means of going about the exchange are innovative, but the act itself is not. Information exchange has been considered a plus factor in the *Petroleum Products*[167] case and *Exxon Corp*.[168] A mentioned by Harrington, 'communication is an economically appropriate basis for distinguishing interdependent and concerted action'.[169] By

[164] Harrington Jr (n 160) 14.
[165] ibid 18.
[166] ibid 21.
[167] *Re Coordinated Pretrial Proceedings in Petroleum Products Antitrust Litigation* [1990] 906 F2d 488 (9th Cir).
[168] *Todd v Exxon Corporation* 275 F3d 191 (2ndCir 2001).
[169] Harrington Jr (n 160) 434.

making price information available in such an immediate manner and because algorithms can have the capacity to run their functions as often as programmed, it is much easier to reach a collusive outcome, without the need for an agreement.

b) *Algorithms as facilitating practices*

In the EU, since Article 101 does not cover parallel behaviour *per se* (understood as tacit collusion), and the concept of plus factors is not used, there is an alternative possible route to address these problems provided by the concept of the facilitating practice. It is argued that the concept of facilitating practices could eventually be used to fight algorithmic tacit collusion.

In the abstract, a facilitating practice is 'conduct by firms, typically in an oligopolistic market, which does not constitute an explicit "hardcore" cartel agreement, and helps competitors to eliminate strategic uncertainty and coordinate their conduct more effectively.'[170] Examples of such practices are communications among competitors, pricing strategies that aid collusion, and interlocking.[171] The facilitating practice can be unilateral or not. For example, establishing a pricing system that helps to reach a collusive outcome could be deemed as a unilateral facilitating practice. However, the enforcement of unilateral conduct as facilitating practice differs from country to country: some jurisdictions have opted to condemn such behaviour, and others have not done so.[172]

In the EU, a facilitating practice can be challenged either under Article 101 or 102 TFEU.[173] There are different types of facilitating practices that are caught by Article 101 TFEU, such as horizontal cooperation agreements which include information exchanges.[174]

The ECJ in the *Woodpulp II* case assessed a pricing practice as a facilitating practice, this being the adoption of advanced price announcements.[175] Petit argues that in this case, the idea took shape that even if tacit collusion in an oligopoly did not fall within the scope of Article 101 TFEU, it should equally be triggered when there is a practice that artificially facilitates collusion.[176] Although Article 101 does not cover parallel behaviour, it can be

[170] OECD Facilitating Practices (n 89) 9.
[171] ibid. Interlocking can be defined as 'structural links between competitors in the form of direct or reciprocal minority shareholdings' (OECD, 'Policy Rountables - Minority Shareholding' (2008) Competition Policy Roundtable DAF/COMP(2008)30 <www.oecd.org/competition/mergers/41774055.pdf> accessed 8 March 2018).
[172] ibid 11.
[173] Stroux (n 57) ch 7.
[174] Petit (n 62) 297.
[175] Stroux (n 57) ch 4.
[176] Petit (n 62) 293.

applied differently, in the shape of facilitating practices, to face such problems.[177] Nevertheless, the current legal assessment of this matter is still ambiguous.[178]

As to the facilitating practices that could fall within the scope of Article 102 TFEU, the current approach dates back to 1965, when a group of professors were commissioned by the predecessor of the EU Commission to study the application of what is now Article 102 TFEU. They suggested 'the possibility of applying an abuse of dominance law to oligopolistic price leadership'.[179] This collective dominance theory (also called joint dominance and oligopolistic dominance) is highly controversial.[180]

The facilitating practices covered by Article 101 TFEU can be considered as circumstantial evidence of an agreement and be an infringement of that article, and are also *per se* illegal when adopted by agreement or concerted practice and prevent competition.[181] It is relevant for this purpose to address information exchanges, for the same reasons as mentioned above for plus factors in the US. In the EU, information exchanges have great importance, as the ECJ has consistently ruled that information exchanges can provide an artificial transparency to the market that may lead to tacit collusion, as it subverts the aim of having competitors act independently.[182] This is precisely the case of algorithms; they create an enhanced market transparency through their functions, such as data collection. In concentrated markets, information exchanges are very dangerous, and even in less highly concentrated ones, as stated in the *Thyssen Stahl* case,[183] they are also not risk neutral.[184] Those dangers may be considerably exacerbated given the capacity that algorithms have to immediately adapt their conduct to match that of competitors or to punish deviation from the oligopolistic price.

As previously stated, facilitating practices, such as the adoption by an industry of a certain pricing system, can be plus factors.[185] In the US, a facilitating practice is defined as 'one that makes it easier for parties to coordinate price or another behaviour in an anticompetitive way'.[186] There is a clear difference between agreements that are tantamount to naked price-fixing agreements and other types of horizontal behaviours.[187] The approach that

[177] Whish and Bailey (n 47) 605.
[178] Wagner-von Papp (n 59) 155.
[179] ibid.
[180] Whish and Bailey (n 47) 607.
[181] Stroux (n 57) 143.
[182] ibid.
[183] Case C-194/99 P *Thyssen Stahl AG v Commission* ECR 2003 -10821.
[184] Wagner-von Papp (n 59) 157.
[185] Stroux (n 57) 121.
[186] Areeda and Hovenkamp (n 132).
[187] OECD Facilitating Practices (n 89) 111.

the FTC and the DOJ have taken towards facilitating practices differs, as such practices have been treated as autonomous misconduct or have gone unchallenged, due to the benefits they bring to the market.[188] When enforcing conduct as an autonomous facilitating practice –an infringement in itself – this has been done under §1 of the Sherman Act, usually for exchanges of information, or under §5 of the Fair Trade Commission Act (''FTC Act''), for other facilitating practices.[189]

As previously suggested (concerning plus factors), a pricing algorithm could be considered a facilitating practice, but only when certain conditions are met. In the US, to treat a pricing practice as a facilitating practice is not new. Advance price announcements in some situations have been assessed as facilitating practices.[190] In the EU, the treatment of pricing systems that lead to information exchange as facilitating prices is similar to the position in the US. [191] The proposed approach of considering certain patterns of algorithms as plus factors in the US can thus effectively be replicated in relation to facilitating practices related to information exchange in the EU. It is argued that there is space in the current regulation of information exchange to undertake enforcement action in an algorithmic tacit collusion case when the necessary collusion-facilitating features are found in the algorithms used by the firms. Moreover, the lack of taking certain precautions to prevent the free flow of information between algorithms could also be investigated, as suggested earlier in the context of plus factors.

Nevertheless, as stated by Petit, the scope of Article 101 is limited to reciprocal contacts between competitors, thus, the facilitating practices should include a link to another competitor.[192] Also, he argues that 'Article 101 TFEU has no teeth in situations of "pure" tacit collusion, where no facilitating measures are needed to tacitly collude'.[193] However, in the case of algorithmic tacit collusion, it could be understood that the function of the algorithm is what creates the collusive outcome, and the algorithms are fed with the information they receive from the market. Therefore it would not be exaggerating to say that, depending on the information characteristics of the algorithm and how fast prices are adapted, it could be considered an information exchange case. Nonetheless, it should be noted that information

[188] ibid.
[189] ibid 6.
[190] ibid 130.
[191] ibid 168.
[192] Petit (n 62) 323
[193] ibid 323.

exchange does also bring procompetitive effects to the market,[194] and thus, a thorough assessment of algorithms and their impact in the market should be carried out in each such case.

The facilitating practices that amount to unilateral conduct covered by Article 102 TFEU are related to the concept of abuse of a collective dominant position.[195] According to Petit, the term of collective dominance has to be understood as a 'situation of observable, exteriorised tacit collusion'.[196] *Laurent Piau v. Commission* affirmed that 'there is a collective dominant position where firms present themselves or act together on a particular market as a collective entity'.[197] Petit also contends that the concept of a 'collective entity' requires a degree of effectiveness of the result of the tacit collusion, thus, to have joint dominance the relevant entities must have colluded.[198] As is the case in a unilateral abuse of dominance case, what is sanctioned is not having this joint dominance, but the abuse of it.[199] The type of abuse required for this to be triggered is not clear, and scholars have proposed different types of abuses.[200] One of these is applying the concept of collective dominance to facilitating practices, for example unilateral price signalling.[201] Stroux argues that by adopting facilitating practices, it would be easier to achieve the collusive outcome because elements such as market transparency could be increased. It is submitted that this interpretation would allow authorities to enforce facilitating practices that escape the scope of Article 101 when such practices are parallel, and there is no agreement or concerted practice whatsoever.[202] However, such an approach has not been judicially endorsed.[203] When dealing with algorithms, this approach could be useful, for instance, if the exchange of information between algorithms was not caught by Article 101, as it was not possible to prove the concerted action. Thus, there is still a possible enforcement option when dealing with algorithms that by any of their characteristics have a negative effect on the market and that lead to tacit collusion.

In the US, §2 of the Sherman Act deals with unilateral conducts, as does Article 102 TFEU. However, §2 of the Sherman Act has proved to be unfit in dealing with an oligopoly.[204]

[194] Wagner-von Papp (n 59) 147.
[195] Stroux (n 57) 168.
[196] Petit (n 62) 325.
[197] Case T-193/02 *Laurent Piau v Commission* [2005] ECR II-209 (GC) 110.
[198] Petit (n 62) 326.
[199] Whish and Bailey (n 47) 615.
[200] Petit (n 62) 332.
[201] ibid 335.
[202] Stroux (n 57) 169.
[203] Siciliani (n 88) 294.
[204] Stroux (n 57) 66.

The reason for such an approach is that no oligopolist has monopoly power,[205] even if the US courts had suggested it in, for example, the *United States v American Airlines*, when the Fifth Circuit provided that 'the two airlines at the moment of acceptance, would have acquired monopoly power [...] the offense of joint monopolization would have been complete'.[206]

FTC Act, Section 5

In the US, there is still one other piece of legislation that needs to be addressed when discussing tacit collusion. The FTC Act §5 was enacted in 1914 to deal with unfair methods of competition, and it also precludes unfair or deceptive practices.[207] FTC Act §5 empowers the FTC to enforce misconduct that violates the Sherman Act[208] by interpretation of what unfair conduct is.[209] The broad language of §5 of the FTC Act has made it useful to enforce in respect of conduct that escapes the scope of the Sherman Act, and it has been used to try tackling oligopolistic interdependence.[210] In the 1970s,[211] the FTC attempted to do so under the concept of shared monopoly but failed, for example in the *Kellogg Co.* case.[212] Moreover, in the *Ethyl* case, it was held that 'the mere existence of an oligopolistic market structure in which a small group of manufacturers engage in consciously parallel pricing of an identical product does not violate the antitrust laws.'[213]

§5 of the FTC Act may seem useful to provide a solution to the algorithmic tacit collusion, due to its theoretical application to oligopolistic behaviour. However, the case law proves that it is not possible to apply it, and therefore it is not an effective tool.[214] Nevertheless, it could be used as a means of dealing with unilateral conduct that amounts to facilitating practices, specifically information exchanges.[215]

F. CONCLUSION

Technological developments are having an impact on the way we live, and e-commerce has changed and will change our consumer behaviour. Together with this revolution come regulatory challenges, and competition law is not oblivious to them. One of the problems that

[205] Gellhorn, Kovacic and Calkins (n 123) 323.
[206] United States v. American Airlines Inc L 743 F2d (5th Cir1984).
[207] Elhauge and Geradin (n 51) 12.
[208] Gellhorn, Kovacic and Calkins (n 123) 324.
[209] Elhauge and Geradin (n 51) 13.
[210] Gellhorn, Kovacic and Calkins (n 123) 324.
[211] Stroux (n 57) 69.
[212] 99 FTC 8 (1982).
[213] *Ethyl Corp v FTC* 729 F2d 128 (1984).
[214] Stroux (n 57) 70.
[215] ibid 124.

scholars and academics have identified is the possibility of algorithms enhancing the risk of tacit collusion. One may agree or disagree as to the likely future extent of algorithm-driven tacit collusion, but we cannot deny it is a possibility. In this sense, this article has focused on explaining how algorithms have the potential to affect the conditions that make tacit collusion possible, such as monitoring and transparency. Further, it has analysed the enforcement tools currently available to EU and US authorities for tackling horizontal conduct, and how they could be interpreted if faced with algorithmic tacit collusion scenario today.

There is already a dispute as to how to deal with tacit collusion, as can be seen through the positions of commentators such as Turner and Posner. Ultimately, the approach depends on a policy decision to alter the possible rational business behaviour in an oligopolistic market. In dealing with this issue, so far, in the EU we encounter Article 101 TFEU which relies on the existence of an agreement, concerted practices or facilitating practices. Also in certain cases it has been pleaded that Article 102 TFEU could serve for confronting tacit collusion. In the US, similarly, the basic requirement of an agreement or meeting of the mind complicates prosecuting cases of tacit collusion. However, the aforementioned does not mean that oligopolistic coordination cannot be subject to enforcement processes, due to the concepts of plus factors and facilitating practices.

Pricing Algorithms have many features that could be deemed as plus factors or facilitating practices; for example, if we consider that certain techniques of data collection are equivalent to pernicious information exchanges. The challenge in this regard is to adequately assess the risks and benefits that the algorithms bring to the market. We cannot forget that algorithmic pricing is an efficiency tool that has business justifications, and their presence does not necessarily mean that there is an anticompetitive aim behind them. [216]

After critically analysing the different approaches to tacit collusion and its enforcement through Article 1 TFEU and §1 of Sherman Act, I consider that current regulations are fully capable of tackling potential cases of algorithmic tacit collusion, with the caveat that some cases may escape enforcement, in much the same way that certain non-algorithmic collusion scenarios do, where regulators are limited by policy considerations. Nonetheless, the interaction between algorithms and tacit collusion is a developing area, and in the future, policy makers may need to reconsider the current antitrust toolkit in order to adequately tackle misconduct.[217]

[216] Mehra (n 104) 1362.
[217] Capobianco and Gonzaga (n 111) 4.