Algorithmic Tacit Collusion: a Threat to the Current EU Competition Law Framework?

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ABSTRACT

This thesis focuses on algorithmic tacit collusion in the context of EU competition law. Particularly, it analyses the regulatory framework when complex autonomous algorithms would be able to reach collusion tacitly, that is without any communication, and without being instructed to collude. In the first chapter, it is argued that Article 101 TFEU can be interpreted broadly to encompass algorithmic tacit collusion. Namely, if it is considered (i) that algorithms express a form of mental consensus by being able to analyse and understand each other's conduct on the market, and (ii) accomplish a facilitating practice by exchanging strategic data so that the uncertainty is reduced, meaning that they have knowingly substituted competition for practical coordination, then algorithmic tacit collusion can fall under the notion of 'concerted practice'. The second chapter deals with the issue of liability. It is argued that a sort of 'causal link' should be established between the algorithm and the company using it so the latter can be held liable for its algorithm's actions. The first way to establish this link is by considering the algorithm and the company as part of the same economic unit, where liability is jointly shared. The second suggestion focuses on the role of awareness: if companies know or ought to know that their algorithms is achieving collusion, and do not prevent it, they should be held liable. Finally, the last chapter focuses on regulatory alternatives. As Article 101 TFEU has been considered by some authors as insufficient to address algorithmic tacit collusion due to the many challenges this interpretation represents, other instruments have been considered. This chapter analyses three of them. The first two operate *ex ante*, namely compliance by design and the monitoring of the algorithm's actions. Such tools, if implemented properly, could help to prevent and dissuade collusion. *Ex post*, it is argued that algorithmic tacit collusion could be sanctioned under the notion of 'abuse of collective dominance' of Article 102 TFEU. The overall conclusion of this thesis is that, to some extent, the current EU legal framework can catch algorithmic tacit collusion, yet many challenges still need to be addressed.

CHAPTER 1. INTRODUCTION

"We will not tolerate anticompetitive conduct, whether it occurs in a smoke-filled room or over the Internet using complex pricing algorithms"[1].

SECTION 1. BACKGROUND AND PROBLEM STATEMENT

Already in 1986, Kranzberg said: *"technology is neither good nor bad; nor is it neutral"*[2]. It all depends on what us, humans, do with it, program it and use it for. The last few years have seen important progress regarding AI[3]. Algorithms are becoming more complex, bigger, and faster by the day. Thanks to techniques such as deep learning, which refers to the ability of computers to learn and extract knowledge without being *"explicitly programmed"*,[4] the technology offers unprecedent possibilities. This is true in a lot of fields, including for market competition. For instance, a pricing algorithm can personalize the price of a product based on the willingness-to-pay of a consumer, thereby allowing individuals who normally could not afford such products, to benefit from them.[5] Pro-competitive effects can thus be produced by deep learning algorithms for consumers.[6]

However, algorithms can also foster anti-competitive conducts and in particular, enhance collusion. The latter is sanctioned under Article 101 TFEU[7], which prohibits any form of collusion between undertakings that would lead to the prevention, restriction, or distortion of

[1] Interview with Bill Baer, 'Former E-Commerce Executive Charged with Price Fixing in the Antitrust Division's First Online Marketplace Prosecution' (April 2015) <https://www.justice.gov/opa/pr/former-e-commerce-executive-charged-price-fixing-antitrust-divisions-first-online-marketplace> accessed 13 October 2022

[2] Melvin Kranzberg, 'Technology and History: "Kranzberg's Laws' [1986] 27 Technology and Culture 545

[3] AI (Artificial Intelligence) designates "*the ability of a digital computer or computer-controlled robot to perform tasks commonly associated with intelligent beings*". See B. J. Copeland, 'artificial intelligence' (*Britannica,* May 2023) < https://www.britannica.com/technology/artificial-intelligence> accessed 15 May 2023

[4] This expression comes from Arthur L Samuel, 'Some Studies in Machine Learning Using the Game of Checkers' (1959) 3 IBM Journal of Research and Development 210. See also OECD, 'Algorithms and Collusion: Competition Policy in the Digital Age' [2017] < https://www.oecd.org/competition/algorithms-collusion-competition-policy-in-the-digital-age.htm> accessed 26 February 2023, 9

[5] Autorité de la Concurrence and Bundeskartellamt, 'Competition Law and Data' [2016] <https://www.bundeskartellamt.de/SharedDocs/Publikation/DE/Berichte/Big%20Data%20Papier.pdf?__blob=publicationFile&v=2> accessed 15 May 2023, 21; Marc Bourreau, Alexandre de Streel and Inge Graef, 'Big Data and Competition Policy: Market Power, Personalised Pricing and Advertising' [2017] SSRN Electronic Journal <https://www.ssrn.com/abstract=2920301> accessed 13 October 2022, 39-46

[6] OECD, 'Algorithms and Collusion' (n 4), 12

[7] Consolidated version of the Treaty on the Functioning of the European Union [2012] OJ C 326

competition within the internal market and that would be capable of affecting trade between Member States.[8] Yet, what happens when humans no longer collude, but algorithms do?

Collusion fostered by algorithms is a phenomenon referred to as 'algorithmic collusion'. The degree of interference played by the algorithm can greatly vary. In its simplest form, the algorithm is merely acting as a tool to implement an agreement concluded by a cartel.[9] In its most complex form, a self-learning algorithm (relying on deep learning) would be able to achieve collusion without any human intention or intervention.[10] The Court of Justice of the European Union (hereafter 'CJEU' or 'Court') has already dealt with algorithms in a competition context. Namely, in *Eturas*[11], it analysed how a pricing algorithm facilitated a cartel.

Because algorithms are used to enhance collusion, they must be taken into consideration in the competitive assessment. Yet, algorithms are not *per se* prohibited. To a greater extent, in a world driven by fast-evolving technology, it might even be counter-productive to rely exclusively on human pricing and trading. How should we thus assess collusion facilitated by algorithms?

From an enforcement's perspective, the most challenging form of algorithmic collusion would rise when different firms would use 'fully autonomous algorithms', or what Ezrachi and Stucke call the 'digital eye'.[12] Such an algorithm is not programmed to achieve collusion, but to achieve a target (maximization of profit, optimization of a service, etc). *How* it reaches it is left to the algorithm. The algorithm will experiment on its own, learning by trial-and-error. Concretely, the algorithm tries different strategies and after a certain number of iterations, decides which one is the best to adopt. As it will be explained *infra*, studies have shown that

[8] Judgment of 4 June 2009, *T-Mobile*, C-8/08, EU:C:2009:343; Judgment of 13 December 2012, *Expedia*, C-226/11, EU:C:2012:795; Judgment of 27 February 2013, *Ordem Dos Técnicos Oficiais de Contas*, C-1/12, EU:C:2013:127; Judgment of 30 January 2020, *Generics (UK) e.a.*, C-317/18, EU:C:2020:52

[9] Described by Ezrachi and Stucke as 'the messenger' scenario: Ariel Ezrachi and Maurice E Stucke, 'Artificial Intelligence & Collusion: When Computers Inhibit Competition' [2017] 2017 University of Illinois Law Review 1784. See also Lea Bernhardt and Ralf Dewenter, 'Collusion by code or algorithmic collusion? When pricing algorithms take over' [2020] European Competition Journal 15; Autorité de la concurrence and Bundeskartellamt, 'Algorithms and Competition' [2019] < https://www.bundeskartellamt.de/SharedDocs/Meldung/EN/Pressemitteilungen/2019/06_11_2019_Algorithms_and_Competition.html> accessed 24 February 2023, 27

[10] Also called the 'Digital Eye' scenario, Ezrachi and Stucke, 'Artificial Intelligence & Collusion' (n 9) 1795; Ariel Ezrachi and Maurice E Stucke, 'Sustainable and Unchallenged Algorithmic Tacit Collusion' [2020] 17 Northwestern Journal of Technology and Intellectual Property 250; Autorité de la concurrence and Bundeskartellamt, 'Algorithms and Competition' (n 9) 43

[11] Judgment of 21 January 2016, *Eturas e.a.*, C-74/14, EU:C:2016:42.

[12] Ezrachi and Stucke, 'Artificial Intelligence & Collusion' (n 9) 1795; Ezrachi and Stucke, 'Sustainable and Unchallenged Algorithmic Tacit Collusion' (n 10) 217

the algorithms learn that the optimal outcome is collusion because it constitutes a joint profit maximisation strategy, which benefits all actors.[13]

This form of algorithmic tacit collusion is the most challenging one because it drastically questions the core principles under which collusion is considered as an anti-competitive practice. Indeed, under EU competition law, Article 101 TFEU prohibits 'explicit collusion', i.e., agreements or concerted practices that require some form of communication between the parties. A singe meeting may already constitute sufficient evidence of communication between competitors.[14] Evidence of some sort of contact is essential to distinguish explicit collusion from 'parallel conduct', namely the situation where undertakings adjust their behaviour on the market based on the existing and/ or anticipated conduct of competitors, for reasons of market structure and economic conditions.[15] Two undertakings can thus adopt similar behaviour because they adapt intelligently to the market, not because they adopt anti-competitive practices.

However, between explicit collusion and parallel conduct exists a grey zone called 'conscious parallelism', or 'tacit collusion'[16]. This refers to a form of coordination achieved without means of communication, i.e., without any explicit agreement. Undertakings manage to maintain this form of coordination by recognising their mutual interdependence. They can match each other's conduct and for instance, set supra-competitive prices, that is prices higher than if competition had occurred in normal conditions.[17] Such dynamics are typically explained with game theories such as the Prisoner's Dilemma.[18]

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[13] OECD, 'Algorithms and Collusion' (n 4) 19; Gonenc Gurkaynak, Burcu Can and Sinem Uğur, 'Algorithmic Collusion: Fear of the Unknown or Too Smart to Catch?' [2020] 1 THE EVOLUTION OF ANTITRUST IN THE DIGITAL ERA: Essays on Competition Policy <https://papers.ssrn.com/abstract=3775095> accessed 26 February 2023, 197

[14] *T-Mobile* (n 8)

[15] Opinion of Advocate General Kokott of 19 February 2009, *T-Mobile*, C-8/08, EU:C:2009:110; Opinion of Advocate General Mengozzi of 30 January 2014, *MasterCard and Others v European Commission*, C 382/12 P; Judgment of 16 December 1975, *Suiker Unie Ea v. Commission*, C-40/73, EU:C:1975:174

[16] Tacit collusion is a term used in opposition to "explicit collusion", which refers to agreements and concerted practices under Article 101 TFEU, requiring a form of communication to achieve coordination.

[17] GSMA, 'Competition Policy in the Digital Age: A Practical Handbook' [2015] <https://www.gsma.com/publicpolicy/resources/competition-policy-digital-age> accessed 27 October 2022; OECD, 'Algorithms and Collusion' (n 4)

[18] The prisoner's dilemma theory emerged in the 50's. In the traditional example, two individuals are arrested for robbery and interrogated separately. They cannot communicate with each other. They are both informed of the following: if one betrays the other, the latter will serve 3 years and the first goes free. If both confess, they go to prison for 2 years. If they remain silent, they each get 1 year prison, as police will be lacking evidence. It illustrates how the parties have everything to win by cooperating with each other while remaining silent. It relies on the fact that, even if there is uncertainty that the other will confess or not, they have more to gain by trusting each other. Similarly, on a market, if two undertakings realise their interdependence, they are better off colluding. Kenji Lee, 'Algorithmic collusion & its implications for competition law and policy' [2018] < https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3213296> accessed 26 February 2023, 36; X, 'The prisoner's dilemma' (*Britannica*) <https://www.britannica.com/topic/positive-sum-game> accessed 23 February 2023; Elvis

For economists, explicit and tacit collusion are the same: the effects of the collusion are identical.[19] From a legal perspective however, tacit collusion is problematic for enforcers because although there is collusion between undertakings, it cannot be qualified as unlawful since there is a lack of communication among competitors. Tacit collusion has been traditionally tolerated so far because (i) of the risk of sanctioning an actual parallel conduct and (ii) those scenarios are rather rare in real life.[20] However, with the rise of algorithms, algorithmic tacit collusion represents a 'revival' of the 'oligopoly problem', namely that on highly concentrated markets with few market players, it is easier for competitors to recognise their mutual interdependence, and so, to tacitly collude.[21] As more and more undertakings rely on algorithms, there is an increased likelihood of tacit collusion fostered by algorithms. Hence, while mere tacit collusion was conceived as an acceptable risk, it is argued that algorithmic tacit collusion should be prohibited and sanctioned under EU (competition) law.[22] The question is: how?

SECTION 2. LITERATURE REVIEW

Algorithmic tacit collusion would thus occur when autonomous algorithms are able to achieve collusion by themselves, i.e., without any prior anti-competitive agreement, and without any form of communication. However, whether it would actually be feasible is heavily debated in literature. In their 2017 study, Petit and Ittoo concluded that significant technological challenges prevented Q-learning[23] algorithms to establish tacit collusion.[24] The year after, Crandall et al. found *inter alia* that not all algorithms learn to cooperate without any

Picardo, 'The Prisoner's Dilemma in Business and the Economy' (*Investopedia*, 22 May 2022) < https://www.investopedia.com/articles/investing/110513/utilizing-prisoners-dilemma-business-and-economy.asp> accessed 26 February 2023

[19] Richard Whish and David Bailey, Competition Law (Oxford University Press 2021) 591

[20] Valeria Caforio, 'Algorithmic Tacit Collusion: A Regulatory Approach' [2022] Competition Law Review < https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4164905> accessed 26 February 2023, 12

21 OECD, 'Algorithms and Collusion' (n 4) 35; Lee (n 18) 31

[22] Caforio (n 20) 12

[23] Q-learning refers to reinforcement learning ("RL") of algorithms, based on values. The purpose of RL is to maximize a given reward by adopting a sequel of actions in response to a dynamic environment. A non-digital example of RL is teaching a dog a series of tricks: the less errors, the more rewards. The dog learns from mistakes and train itself in order to maximize its reward the next time. The 'Q' stands for 'quality', which indicates how useful an action is to gain some future reward. Chathurangi Shyalika, 'A Beginners Guide to Q-Learning' (*Towards Data Science*, 2017) <https://towardsdatascience.com/a-beginners-guide-to-q-learning-c3e2a30a653c> accessed 19 December 2022; Paul Sayak, 'An Introduction to Q-Learning: Reinforcement Learning' (*Floydhub*, May 2019) <https://blog.floydhub.com/an-introduction-to-q-learning-reinforcement-learning/> accessed 19 December 2022

[24] Ashwin Ittoo and Nicolas Petit, 'Algorithmic Pricing Agents and Tacit Collusion: A Technological Perspective' in Alexandre de Streel and Hervé Jacquemin (eds), *L'intelligence Artificielle et le Droit* (Larcier 2017)

communication and only some of them are more efficient than humans at collusion.[25] Results are thus mixed, which is why Schawlbe or Ittoo and Petit argue that algorithmic tacit collusion is much more difficult to achieve than suggested in the literature due to significant technological challenges and therefore, does not represent an urgent competitive issue.[26]

On the contrary, more recent studies (from 2019 and onwards) show evidence that algorithms learn to collude without any human intervention or intention. From a theoretical and experimental perspective (as it is complicated to empirically assess the risk algorithmic collusion represents), researchers find that in some settings, and particularly in transparent oligopolistic markets with homogeneous products, algorithmic tacit collusion would be more likely to thrive, which represents an alarming issue for law enforcers.[27] Indeed, the more transparent the market, the more information competitors have about each other's. As more data are available between competitors, market coordination is eased.[28] This is confirmed by the Commission in its Guidance on the applicability of Article 101 TFEU: *"[c]ollusive outcomes are more likely in transparent markets"*[29]. In addition, where the market is highly concentrated, i.e., where high market shares are allocated to only a few market players[30], the exchange of information may enable market players to better be aware of competitors' market position and commercial strategy, thereby facilitating collusion.[31] Finally, in the case of homogenous products which are highly substitutable, price will play a prominent role. If a firm competes on the price, algorithms may rapidly detect the price modification and align their prices, thereby depriving the firm from any significant sales.[32] Hence, coordinating prices is also facilitated when customers can easily switch to products and services of other firms. Conclusively, on

[25] Ai Deng, 'When Machines Learn to Collude: Lessons from a Recent Research Study on Artificial Intelligence' [2017] <https://www.ssrn.com/abstract=3029662> accessed 18 December 2022; Jacob W Crandall and others, 'Cooperating with Machines' [2018] 9 Nature Communications 233

[26] Ittoo and Petit (n 24); Ulrich Schwalbe, 'Algorithms, Machine Learning, and Collusion' [2018] < https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3232631> accessed 15 May 2023

[27] Judgment of 23 November 2006, *Asnef-Equifax*, C-238/05, EU:C:2006:734; Autorité de la Concurrence and Bundeskartellamt, 'Competition Law and Data' (n 5); Emilio Calvano and others, 'Artificial Intelligence, Algorithmic Pricing, and Collusion' [2019] 110 American Economic Review 3267; Matthias Hettich, 'Algorithmic Collusion: Insights from Deep Learning' [2021] <https://www.ssrn.com/abstract=3785966> accessed 2 October 2022

[28] Autorité de la Concurrence and Bundeskartellamt, 'Competition Law and Data' (n 5); Bruno Lasserre and Andreas Mundt, 'Competition Law and Big Data: The Enforcer's View' [2017] Italian Antitrust Review 87; OECD, 'Big Data: Bringing Competition Policy to the Digital Era. Background Note by the Secretariat' [2017] <https://one.oecd.org/document/DAF/COMP(2017)4/en/pdf> accessed 15 May 2023

[29] Guidelines on the Applicability of Article 101 of the Treaty on the Functioning of the European Union to Horizontal Co-Operation Agreements, OJ C 11, 14 January 2011

[30] OECD, 'Market Concentration. Issues Paper by the Secretariat' [2018] <https://one.oecd.org/document/DAF/COMP/WD(2018)46/en/pdf> accessed 15 May 2023

[31] *Asnef-Equifax* (n 27)

[32] Ezrachi and Stucke, 'Artificial Intelligence & Collusion' (n 9) 1775; Ezrachi and Stucke, 'Sustainable and Unchallenged Algorithmic Tacit Collusion' (n 10) 217

concentrated and transparent markets, with homogenous products, tacit collusion is more *likely* to emerge.

Finally, when analysing Q-learning pricing algorithms' behaviours, Calvano et al. found that they *"systematically learn to collude"*[33]. Without any prior knowledge, pricing algorithms learn by trial and error, and punish in case of deviation. After a deviation has been punished, algorithms gradually go back to supra-competitive prices. Even more so, they *"leave no trace whatever of concerted action: they do not communicate with one another, nor have they been designed or instructed to collude"*[34]. Klein's results also point in this direction. In the competitive environment he created, he found that Q-learning pricing algorithms instructed to maximize their profits learn to collude without communicating with each other.[35]

Last year, Hettich focused not on Q-learning, but on deep learning pricing algorithms and found that they can collude *"significantly faster"*[36] than Q-learning algorithms. He also provided evidence on the fact that algorithmic tacit collusion is more likely to emerge on certain markets, as described *supra*. He found that while deep learning algorithms systematically collude in duopoly by setting supra-competitive prices, the larger the number of participants on a market, the less collusion. Beyond seven firms on a market, he did not observe collusion. Should we thus not worry about algorithmic tacit collusion given that it is only likely to emerge when there is a limited number of market players using deep learning algorithms? In our view, those results remain alarming. If we take the example of the digital sector, which heavily relies on algorithms to process the huge amount of data they collect,[37] a few firms dominate several 'digital ecosystems'[38].[39] In competition law terms, it translates as an industry highly concentrated and fairly transparent, hence prone to collusion. If those firms were to use deep learning algorithms instructed to maximize their profit, it is likely that tacit collusion would emerge. In other words, while it is true that beyond seven market players, collusion would

[33] Emilio Calvano and others (n 27)
[34] ibid
[35] Timo Klein, 'Autonomous Algorithmic Collusion: Q-learning under Sequential Pricing' (2021) 52 The RAND Journal of Economics 538
[36] Hettich (n 27) 1
[37] Autorité de la Concurrence and Bundeskartellamt, 'Competition Law and Data' (n 5) 36
[38] Because of the multitude of markets on which those forms operate, and because it is hard to define markets due to specificities of the digital world (non-monetary priced products and services, network effects, etc), the notion of 'digital ecosystem' is sometimes preferred to traditional relevant markets. Jacques Crémer, Yves-Alexandre de Montjoye and Heike Schweiter, *Competition Policy for the Digital Era*(Publications Office 2019) <https://data.europa.eu/doi/10.2763/407537> accessed 19 December 2022*;* OECD, 'Handbook on Competition Policy in the Digital Age' [2022] < https://www.oecd.org/daf/competition-policy-in-the-digital-age/> accessed 15 May 2023
[39] Nicolas Petit, 'American Tech Giants Are Fiercely Competitive Monopolies' [2018] 103 ESB <https://esb.nu/esb/20047701/american-tech-giants-are-fiercely-competitive-monopolies> 82

probably not emerge, in some industries such as the digital sector, only a few participants are required to reach tacit collusion. In addition, given the important market power they hold, it is likely that such a coordination would be highly damaging to end-users.

Literature review shows that experimentally speaking, algorithms tacitly collude. While the results would probably be nuanced in a more complex market in real life, the studies clearly highlight the risk that algorithms represent regarding collusion.

From a regulatory perspective, as explained *supra*, Article 101 TFEU is traditionally considered inadequate to address algorithmic tacit collusion since this provision requires evidence of communication.[40] For this reason, many authors have left out Article 101 TFEU as a regulatory answer and either focused on alternative instruments or suggested further research before taking action. For instance, Gürkaynak, Can and Uğur admit that while *"the risk is likely, […] further research is necessary before taking action"*[41]. Gautier, Ittoo and Van Cleynenbreugel also agreed that better understanding of AI algorithms is necessary and that current legal policies do not require immediate modification.[42]

However, as this provision is the main instrument prohibiting collusion, we believe that Article 101 TFEU deserves a thorough analysis before being left out. It has not initially been created to address anti-competitive practices fostered by AI, so bearing in mind the purpose of Article 101 TFEU, could it be interpreted in a way as to address algorithmic tacit collusion? And if so, how? This question is at the heart of this thesis, which has as one of its objectives to gather the scattered discussions and propositions around this topic and propose a coherent answer to these questions.

Additionally, even fewer authors have focused on the question of liability under this provision. Provided that algorithmic tacit collusion has been established, who should be held liable for such conduct? The humans? The algorithms? Would it be possible to hold a computer program liable? And if we hold humans liable, how to impute their liability if they did not intervene in the process of collusion? There is a clear gap on this issue, which, we believe, deserves attention. Consequently, the question of liability will be deeply analysed as well.

Finally, as pointed out *supra*, since the extent to which Article 101 TFEU could be applied to algorithmic tacit collusion is still uncertain, several authors have turned to other regulatory frameworks. Some of those alternatives deserve attention. For instance, it has been

[40] OECD, 'Algorithms and Collusion' (n 4); Gürkaynak, Can and Uğur (n 13) 197; Francisco Beneke and Mark-Oliver Mackenrodt, 'Remedies for algorithmic tacit collusion' [2021] 9 Journal of Antitrust Enforcement 152
[41] Gürkaynak, Can and Uğur (n 13) 208
[42] Axel Gauthier, Ashwin Ittoo and Pieter Van Cleynenbreugel, 'AI algorithms, price discrimination and collusion: a technological, economic and legal perspective' [2020] 50 Eur J Law Econ 430

suggested to reinforce *ex ante* rules, where algorithms would have to be subjected to approval by competition authorities before being used on the market ('compliance by design').[43] Other proposals have also been made to detect, prevent, sanction or remedy to algorithmic tacit collusion. Harrington suggests establishing some *per se* unlawful algorithms.[44] Lamontanaro advocates for bounty hunters to detect the algorithmic cartels.[45] Beneke and Mackenrodt recommend relying on fines and structural and behavioural remedies to deter collusion. The list could go on, but our point is that several authors turned to other regulatory instruments to provide answers on how and to what extent algorithmic tacit collusion could be prevented, discouraged, or punished. Which ones and whether they would be effective are the final questions this thesis will address.

In summary, this thesis will analyse three aspects. The first one concerns Article 101 TFEU's interpretation, and in particular, whether a broad interpretation can be adopted to address algorithmic tacit collusion. The second aspect, and probably the biggest gap in literature, is the issue of liability. Finally, it is important to critically assess some relevant alternatives to Article 101 TFEU that have been suggested in the last years to prevent, discourage, or sanction algorithmic tacit collusion.

SECTION 3. RESEARCH QUESTIONS

The main research question for this thesis will be: to what extent is the current EU competition law framework capable of addressing algorithmic tacit collusion?

The sub-questions are the following:

- How can the current (conditions of) Article 101 TFEU be interpreted to catch algorithmic tacit collusion?
- How should liability be assessed in case of algorithmic tacit collusion and where lies the burden of proof?
- Considering the difficulties of capturing algorithmic collusion under Article 101(1) TFEU, what alternative remedies under competition law could be provided to prevent, discourage, and/or sanction such conduct?

[43] Ezrachi and Stucke, 'Artificial Intelligence & Collusion' (n 9) 1775
[44] Joseph Harrington Jr, 'Developing Competition Law for Collusion by Autonomous Price-Setting Agents' [2017] 14 Journal of Competition Law & Economics 331
[45] Aleksandra Lamontanaro, 'Bounty Hunters for Algorithmic Cartels: An Old Solution for a New Problem' [2020] 30 Fordham Intellectual Property, Media and Entertainment Law Journal 1259

SECTION 4. METHODOLOGY

As this subject is relatively recent, most of the sources are doctrinal. Indeed, to our knowledge, the CJEU has produced only one case regarding algorithmic collusion: *Eturas*[46]. Other cases relevant to explain more traditional concepts, such as collusion under Article 101 TFEU, will be used.

With regard to the legislation, Article 101 TFEU will be mainly used. Besides that, instruments such as the AI Act[47] or the DMA will be employed when relevant, for instance to draw analogies.[48]

Finally, most of the sources are in English. Nonetheless, to broaden the research scope, a few sources are in French and Dutch.

SECTION 5. OVERVIEW OF THE FOLLOWING CHAPTERS

This introductory chapter focused on explaining what algorithmic (tacit) collusion is and why it matters in competition law. It also provided a brief overview of the type of markets on which algorithmic tacit collusion is likely to emerge, and of studies analysing whether such coordination is technically feasible.

The second chapter will focus on the traditional tool under which collusion is caught under EU law: Article 101 TFEU. It will analyse to which extent traditional concepts such as 'coordinated practices' can be applied to algorithms tacitly colluding and under which conditions it can be considered that they 'communicate'.

The third chapter will tackle the issue of liability. It will examine who should be held liable, and under which conditions liability can be attributed in cases of algorithmic tacit collusion.

In the fourth chapter, regulatory alternatives will be explored. It will analyse some of the tools that could be used to prevent, discourage, and sanction algorithmic tacit collusion.

Finally, the last chapter will conclude.

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[46] *Eturas e.a* (n 11)

[47] European Commission, 'Proposal for a Regulation of the European Parliament and of the Council Laying Down Harmonised Rules on Artificial Intelligence (Artificial Intelligence Act) and amending certain Union legislative acts' [2021] COM/2021/206

[48] Regulation (EU) 2022/1925 of the European Parliament and of the Council of 14 September 2022 on contestable and fair markets in the digital sector and amending Directives (EU) 2019/1937 and (EU) 2020/1828 (Digital Markets Act) [2022] OJ L 265/1

CHAPTER 2. ALGORITHMIC TACIT COLLUSION UNDER THE TRADITIONAL FRAMEWORK OF ARTICLE 101 TFEU

As seen in the introductory chapter, algorithmic tacit collusion is challenging as it constitutes not only a revival of the oligopoly problem, but also an intensification thereof. On the question of how to address this issue, Article 101 TFEU, which is *the* provision of EU law regarding collusion, might be an answer. Due to the importance and relevance of this provision, this chapter focuses solely on it. In particular, it aims to analyse whether algorithmic tacit collusion can fall under the notions 'agreements' and 'concerted practices' inasmuch those concepts are broadly interpreted.[49]

Before diving in, it is important to recall that this thesis focuses solely on 'fully autonomous algorithms', that is algorithms which are programmed not to achieve collusion, but to reach maximisation. They are free to decide how to do so, which, as seen in chapter 1, will most likely lead to collusive strategies since it is the most advantageous outcomes.

SECTION 1. BASIC NOTIONS OF ARTICLE 101 TFEU

Article 101 TFEU (ex Article 81 EC) is one of the cornerstones of EU competition law. Under Article 101(1) TFEU, any form of collusion (or 'coordination') is prohibited when it restricts competition within the internal market and may affect trade between Member States.[50] In short, this provision forbids cartel agreements between competitors.[51] Such practices will only be forbidden when they have a negative and appreciable effect on competition and when Article 101(3) TFEU's criteria are not satisfied.[52] Indeed, an agreement which is *a priori* prohibited under Article 101(1) TFEU can benefit from an exemption under Article 101(3) TFEU when it produces more pro-competitive effects than harm the market. If the cumulative conditions of this provision are met, the agreement will be considered lawful.[53]

This provision also distinguishes three types of coordination, namely agreements between undertakings, decisions by associations of undertakings and concerted practices. As

[49] OECD, 'Algorithms and Collusion – Note from the European Union' [2017] < https://one.oecd.org/document/DAF/COMP/WD(2017)12/en/pdf> accessed 26 February 2023, 33
[50] Consolidated version of the Treaty on the Functioning of the European Union [2012] OJ C 326, art 101
[51] Richard Whish and David Bailey, Competition Law (Oxford University Press 2021), 103
[52] Judgment of 13 December 2012, *Expedia*, C-226/11, EU:C:2012:795, para 16-17; Judgment of 30 January 2020, *Generics (UK) e.a.*, C-317/18, EU:C:2020:52, para 31
[53] Whish and Bailey (n 51) 155

this thesis focuses on collusion between two or more undertakings, the decisions by associations of undertakings will not be studied.

'Agreements' are a form of coordination which express a 'concurrence of wills' of committing an anti-competitive practice.[54] The intent and the form of the agreement are both irrelevant. For instance, gentlemen's agreement and ongoing negotiations satisfy the concept of agreement inasmuch the parties have expressed their joint intent of behaving in a certain way on the market (by fixing prices or sharing markets for example). [55]

Article 101(1) is not limited to strict agreements, as it would defeat the purpose of this provision.[56] Coordination which, *"without having been taken to a stage where an agreement properly so called has been concluded, knowingly substitutes for the risk of competition practical cooperation between them"*[57], is referred to as a 'concerted practice'. The landmark case *Dyestuffs* (*ICI v Commission*)[58] on concerted practices has been elaborated in *Suiker Unie v Commission* (the *Sugar cartel* case) [59], where the Court ruled that there was no need to show evidence of an actual plan. Those two cases provided the legal test of a concerted practice: there must be a form of *mental consensus*, where parties *knowingly* substitute competition for practical *cooperation*.[60] The term 'mental consensus' is not commonly used in case law but is a term suggested by Whish and Bailey and is used in this thesis to refer to any form of direct or indirect contact between the parties.[61] There is no necessity to prove a 'meeting of minds' or a 'common course of conduct',[62] nor must the consensus be achieved verbally.[63]

Although Article 101 distinguishes agreements and concerted practices, it is established case law that this distinction is purely formal.[64] In fact, the Court confirmed that they both

[54] Judgment of 26 October 2000, *Bayer v Commission*, T-41/96, EU:T:2000:242, para 69, confirmed in Judgment of 6 January 2004, *Bundesverband der Aezneimittel-Importeure eV v Bayer*, C-2/01 P and C-3/01 P, EU:C:2004:2, para 97

[55] Judgment of 13 July 2006, *Commission v Volkswagen*, C-74/04 P, EU:C:2006:240, para 37; Judgment of 8 July 2008, *BPB v Commission*,T-53/03, EU:T:2008:254, para 82; Judgment of 29 September 2021, *Nippon Chemi-Con Corporation v Commission*, T-363/18, EU:T:2021:638, para 64

[56] Whish and Bailey (n 51) 104

[57] Judgment of 26 January 2017, *Duravit e.a. v Commission*, C-609/13 P, EU:C:2017:46, para 70. See also Judgment of 8 July 1999, *Commission v Anic Partecipazioni SpA*, C-49/92 P, EU:C:1999:356, para 115; Judgment of 29 September 2021, *Rubycon and Rubycon Holdings v Commission*, T-344/18, EU:T:2021:637, para 104

[58] Judgment of 14 July 1972, *Imperial Chemical Industries v Commission*, C-48/69, EU:C:1972:70, para 64

[59] Judgment of 16 December 1975, *Suiker Unie Ea v. Commission*, C-40/73, EU:C:1975:174

[60] ibid

[61] ibid

[62] Judgment of 14 March 2013, *Fresh Del Monte Produce v Commission*, T-587/08, EU:T:2013:129, para 300

[63] Whish and Bailey (n 51) 118

[64] *Commission v Anic Partecipazioni SpA* (n 57); Judgment of 4 June 2009, *T-Mobile*, C-8/08, EU:C:2009:343, paras 23-24

pursue the same aim[65], i.e., catching 'explicit collusion',[66] and they are only distinguishable in their intensity and form.[67] Agreements are more intense in the sense that they imply a more explicit form of communication than concerted practices. Accordingly, because tacit collusion stems inherently from scenarios where the is a lack of communication, the notion of 'agreement' is unfit to catch tacit collusion. Concerted practice, on the other hand, is a form of coordination that has not been taken to the stage of a proper agreement meaning that from an evidentiary perspective, it is less onerous than an agreement, because it is sufficient to prove that, considering a number of coincides and indicia, the presence of a concerted practice is the only plausible explanation for the market outcome.[68] Therefore, it is argued that the notion 'concerted practice' is the only one which could be fit to address algorithmic tacit collusion. This is analysed in the next section.

SECTION 2. A REFORM OF THE NOTION OF 'CONCERTED PRACTICES'?

Concerted practices are a form of collusion where there is a mental consensus among competitors to knowingly substitute competition for practical cooperation.[69] The question is therefore: when autonomous algorithms tacitly collude, could this practice amount to a concerted practice? The following sections analyse first the condition of 'mental consensus', and secondly, the 'knowing substitution' of competition for practical cooperation.

I. CAN ALGORIHTMS REACH MENTAL CONSENSUS?

As explained *supra*, the mental consensus results from any direct or indirect contact between competitors. It is not required to prove that competitors have formally attempted to adopt a certain strategy or have colluded over their future conduct on the market. It rather refers to a 'statement of intention' which leads to a decreased uncertainty of a competitor's conduct on the market.[70] As Whish and Bailey put it, *"a concerted practice does not require an actual plan; it strictly precludes contact that could influence conduct on the market or disclose one's*

[65] Judgment of 23 November 2006, *Asnef-Equifax*, C-238/05, EU:C:2006:734
[66] Judgment of 5 December 2013, *Solvay v Commission*, C-455/11 P, EU:C:2013:796, para 52; *Rubycon and Rubycon* (n 57) para 105
[67] *Commission v Anic Partecipazioni SpA* (n 57) para 132
[68] Stefan Thomas, 'Harmful Signals: Cartel Prohibition and Oligopoly Theory in the Age of Machine Learning' [2019] 15 J Comp L & Econ 180; Whish and Bailey (n 51) 118-120
[69] Whish and Bailey (n 51) 118
[70] ibid

future conduct on the market"[71] and although this implies some form of reciprocity, it is sufficient that the other competitor accepts the disclosure of intention or conduct.[72]

Regarding algorithms, it has already been argued that 'signalling algorithms' might meet the standard of mental consensus.[73] A signalling algorithm sends a 'signal' to other firms on the market, inviting them to collude by, for example, increasing its prices. Algorithms of other firms notice the signals and can decide to align their behaviour on the first firm by also increasing their prices. Eventually, supra-competitive prices are achieved, and collusion is tacitly established.[74] In such cases, it can be found that those exchanges of signals are a form of contact which meets the requirement of mental consensus.

In the case of autonomous algorithms, it is more complex as they do not send signals but are only programmed to maximize profit, optimize performances, etc. Nonetheless, it can still be argued that there is a form of mental consensus. Indeed, algorithms reach maximisation by constantly analysing the market and reacting (almost) directly to changes in market conditions. Those market conditions are, in fact, created by algorithms which learn to 'decode' each other, to 'learn each other's mind'.[75] In other words, autonomous algorithms would 'answer' to each other, without actually communicating.[76] According to the *Sugar cartel* case, a firm cannot influence the conduct on the market of an actual or potential competitor nor disclose the course of conduct.[77] So, if algorithms are able to 'read each other's mind', they are divulging information on their course of conduct. The condition of reciprocity is also met since it is satisfied as soon as a competitor accepts information about the intention of conduct of a firm. Consequently, it could be considered that autonomous algorithms are so advanced that they can process other algorithms' information in such a way as to understand their intent of conduct on the market. There is, in other words, a 'facilitating practice' which makes it easier to achieve the benefits of tacit coordination.[78]

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[71] Whish and Bailey (n 51) 120
[72] ibid
[73] OECD, 'Algorithms and Collusion' (n 49) 38; Elena Donini, 'Collusion and Antitrust: The Dark Side of Pricing Algorithms' (thesis, Università Di Bologna 2019) 107
[74] OECD, 'Algorithms and Collusion' (n 49) 30-31
[75] ibid 8; Gonenc Gurkaynak, Burcu Can and Sinem Uğur, 'Algorithmic Collusion: Fear of the Unknown or Too Smart to Catch?' [2020] 1 THE EVOLUTION OF ANTITRUST IN THE DIGITAL ERA: Essays on Competition Policy <https://papers.ssrn.com/abstract=3775095> accessed 26 February 2023, 203
[76] Giuseppe Colangelo 'Artificial Intelligence and Anticompetitive Collusion: From the 'Meeting of Minds' Towards the 'Meetings of Algorithms'?' [2021] 74 TTLF Stanford Law School Working Paper < https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3751255> accessed 26 February 2023, 10
[77] *Suiker Unie* (n 59)
[78] Whish and Bailey (n 51) 599

Accordingly, even if autonomous algorithms do not send explicit signals to each other, it could still be considered that, because they learn to decode each other by analysing their respective conducts on the market, there is an indirect form of contact between the parties or, in other words, a mental consensus. If one accepts such an interpretation, the first condition is met.

II. THE QUESTION OF 'KNOWINGLY SUBSTITUTE'

The second requirement is that the parties must *knowingly* substitute the risk of competition by practical cooperation. Firms often 'know' what they are doing when, for instance, they publicly reveal their future pricing strategy publicly. Yet, when it comes to algorithms acting fully independently, can it be considered that their mere interactions fulfil the requirement of 'knowingly'? There is no threshold established to know what is made 'knowingly' or not. [79] Once again, it comes down to a question of interpretation.

Calzolari argues for the positive. His proposal stems from the idea that collusion should be interpreted broadly. Indeed, although it is perfectly lawful to take into account the present or foreseeable conduct of his competitors, *"[…] it is contrary to the rules of competition contained in the Treaty for a producer to cooperate with his competitors, in any way whatsoever, […]"*[80]. In other words, an undertaking must always be prohibited to cooperate with its competitors, as it would otherwise disregard the essence of competition law itself. Hence, one should adopt a broad interpretation of the concept of collusion to ensure that competition rules will be observed and thereby guarantee the proper functioning of the internal market and protect consumers' well-being.[81] The Court has already accepted broad interpretations regarding collusion, for instance when it found that *passive* modes of participation in an infringement may also constitute indicia of collusion[82] and that a private exchange of information between parties was sufficient to establish a cartel since it reduced the degree of uncertainty, restricting thereby competition.[83]

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[79] Thomas (n 68) 183

[80] *Imperial Chemical Industries* (n 58) para 118

[81] Radostina Parenti, 'Competition policy' (*European Parliament, April 2023)* < https://www.europarl.europa.eu/factsheets/en/sheet/82/competition-policy#:~:text=The%20main%20objective%20of%20the,and%20society%20as%20a%20whole.> accessed 5 June 2023

[82] Judgment of 28 June 2005, *Dansk Rørindustri e.a. v Commission*, joined cases C-189/02 P, C-205/02 P, C-208/02 P and C-213/02 P, EU:C:2005:408, para 143

[83] Judgment of 19 March 2015, *Dole v Commission*, C-286/13 P, EU:C:2015:184, para 121; Luca Calzolari, 'The Misleading Consequences of Comparing Algorithmic and Tacit Collusion' [2021] 6 European Papers 1209-1211

Consequently, Calzolari argues that the notion of 'knowingly substitute the risk of competition by coordination' should equally be interpreted broadly. To the same degree that the Court has already ruled that exchange of information between the competitors lead to a decreased uncertainty,[84] he argues that *mutatis mutandis*, when an undertaking uses its algorithm to track information publicly disclosed online by other parties, the uncertainty around the competitors' current and future actions is decreased. Hence, *"[s]ince many – if virtually not all the – undertakings are likely to use similar automatic software programmes for the purpose of adjusting their own prices to those of their competitors, it seems tenable to conclude that algorithms indeed engage in some form of contact – if not proper communication – among themselves which result in the replacement of uncertainty with mutual knowledge"*[85]. In other words, for Calzolari, this constitutes an exchange of information among competitors, which is sufficient to establish a concerted practice. This reasoning would be in line with the Guidelines on the applicability of Article 101 TFEU[86], which provides that *"information exchange can constitute a concerted practice if it reduces strategic uncertainty in the market thereby facilitating collusion, that is to say, if the data exchanged is strategic"*[87].

Conclusively, considering that the algorithms on the market exchange 'strategic data', uncertainty is reduced, collusion is facilitated, and so it may be constitutive of a concerted practice. If one accepts such a reading, then the second requirement is also met.

III. DISCUSSION

To sum up, in order to have a concerted practice, two main elements must be met: there must be (i) a mental consensus (ii) to knowingly substitute competition by practical coordination. *In casu*, the first condition would be met when it is considered that the autonomous algorithms on the market interact in such a way that not only do they create the market conditions, but they also learn to decode each other. By doing so, they state their intention to act in a certain way, i.e., to collude. Secondly, precisely because those algorithms exchange information on the market, strategic uncertainty is reduced, indicative of competition

[84] *T-Mobile* (n 64) para 35; *Dole v Commission* (n 83) para 121
[85] Luca Calzolari (n 83) 1211
[86] Guidelines on the Applicability of Article 101 of the Treaty on the Functioning of the European Union to Horizontal Co-Operation Agreements, OJ C 11, 14 January 2011 (Guidelines on the Applicability of Article 101) para 61
[87] ibid para 61

being substituted by coordination. Accordingly, algorithmic tacit collusion could be considered as a concerted practice, and therefore prohibited under Article 101 TFEU.

The main advantage of having a broad interpretation of the concept of 'concerted practices' is that there is no need for a substantial modification of the competition rules: Article 101 TFEU can still be used. Law is often behind technology, and so relying on existing provisions is an advantage that should not be overlooked.

On the other hand, we should be careful on how we interpret 'concerted practices', so we do not face an important number of false positives. Concretely, a broad interpretation should not result in real cases of parallel conduct being considered as concerted practices. In that sense, Hawkes considers that the level of evidence would be too high to distinguish algorithmic tacit collusion from parallel conduct.[88] Although we agree that parallel conduct should not be sanctioned, we believe that the whole proposal should not be thrown just because of that. Rather, we argue for a more nuanced interpretation.

Calzolari's proposal suggests that any information exchange between autonomous algorithms leads to a decreased uncertainty. Yet, if we look at current markets without algorithms, information is available between competitors, but it does not necessarily mean that coordination is occurring. It is true however, that more information (and more transparency in general) increases the risk of collusion (see chapter 1). So, a balance should be found. In our opinion, not all information exchanged between the algorithms has the same worth. The Guidelines on the applicability of Article 101 TFEU provide that *"[w]hen a company receives strategic data from a competitor […], it will be presumed to have accepted the information and adapted its market conduct accordingly unless it responds with a clear statement that it does not wish to receive such data"*[89]. Accordingly, the proposal should be reformulated as follows: exchange of *strategic* information between algorithms which reduces uncertainty regarding competitors' intentions or conducts on the market can amount to a concerted practice.

The following question is then naturally: what is 'strategic' information? The Guidance specifies in that regard that *"[s]trategic uncertainty in the market arises as there is a variety of possible collusive outcomes available and because companies cannot perfectly observe past and current actions of their competitors and entrants".* So, if information enables a firm to

[88] Colm Hawkes, 'A Market Investigation Tool to Tackle Algorithmic Tacit Collusion: An Approach for the (Near) Future' [2021] 3 Research Papers in Law < https://www.coleurope.eu/sites/default/files/research-paper/ResearchPaper_3_2021_Colm_Hawkes.pdf> accessed 26 February 2023, 15
[89] Guidelines on the Applicability of Article 101 (n 89) para 62

determine the competitors' past and current actions, it should be considered as 'strategic'. What this information is exactly will probably vary depending on the case at stake.

Nonetheless, our proposal still relies on the idea that algorithms 'decoding' and 'learning from each other' is a form of mental consensus. This is accepting the fact that autonomous algorithms are so powerful that they can anticipate their competitor's conduct. This should not be ruled out, but it is also questionable if algorithms would be able to achieve such results on real life markets, which tend to be very complex (or at least, more complex than the ones created in experimental studies, see chapter 1).

In conclusion, the elements of 'concerted practice' can be interpreted in such a way that it could catch algorithmic tacit collusion. However, it requires to have an open mind on what is 'mental consensus' when it occurs between computers, and what is 'knowingly substitute competition for coordination'.

SECTION 3. CONCLUSION

Interpreting concerted practices to include algorithmic tacit collusion is challenging, but not impossible. If it is recognized that algorithms decoding each other is a form of mental consensus, and that by exchanging strategic information, they knowingly substitute competition for coordination, then the notion of concerted practice can be applied to algorithmic tacit collusion.

Nevertheless, whether it is desirable is another question. We have pointed out that using the existing framework is an advantage in a fast-evolving world, where law tends to arrive too late after the technology has emerged. On the other hand, one negative aspect is that a broad interpretation (necessary to encompass algorithmic tacit collusion) gives rise to the issue of the false positives. It will be challenging for enforcers to draw a line between what is actual parallel conduct and what is algorithmic tacit collusion. For this reason, (i) competition authorities should have access to algorithms so they can assess whether there was an exchange of strategic data and (ii) a reversal of the burden of proof should be considered to ease the evidentiary burden on enforcers. Those suggestions are discussed further, namely and respectively under section 3 of chapter 3, and in chapter 4 regarding compliance by design.

Finally, due to the difficulties of establishing one legal test for concerted practices regarding algorithmic tacit collusion, it has been suggested that Article 101 TFEU is simply not the best tool to tackle this issue. Some alternatives will thus be studied in the fourth chapter.

CHAPTER 3. LIABILITY

Assuming that competition authorities succeed to catch algorithmic tacit collusion under Article 101 TFEU, the question of liability arises. Already in 2017, Margrethe Vestager, the current European Commissioner for Competition declared that *"[…] we need to make it very clear that companies can't escape responsibility for collusion by hiding behind a computer program."*[90]. The question is then: who must be held liable for the collusive practice? We face an outcome where humans never intended to collude, yet the algorithm did. So, can and should an algorithm be held liable under competition law? The first section focuses on *who* should be held liable. The following sections analyse *how* liability can be attributed. Two hypotheses are considered: when the algorithm is granted a form of legal personality (section 2) and when it does not (section 3). The fourth section concludes.

SECTION 1. LIABILITY, YES, BUT OF WHOM?

Traditionally, three options have been considered regarding AI liability: to hold the AI liable, the humans using it, or none of them.[91]

Firstly, holding none of them liable is not desirable, nor realistic as it would involve a *de facto* immunity for companies using algorithms tacitly colluding.[92]

Secondly, holding *solely* algorithms accountable only works in theory. If, for example, a cartel is formed by autonomous algorithms and investigated by the Commission, how could an algorithm answer to a statement of objections? It simply cannot. Similarly, an algorithm itself cannot answer for its actions: it cannot, for instance, pay financial penalties, nor go to jail.[93] In other words, it is *de facto* impossible to hold solely an algorithm liable and a 'human-in-the-loop' is necessary.

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[90] Margrethe Vestager, 'Algorithms and competition' (Bundeskartellamt 18th Conference on Competition, Berlin, 16 March 2017)

[91] Salil K. Mehra, 'Antitrust and the Robo-Seller: Competition in the Time of Algorithms' [2016] 100 Minnesota Law Review 1366; Stephanie Assad and others, 'Algorithmic Pricing and Competition': Empirical Evidence from the German Retail Gasoline Market' [2020] 8521 CESifo Working Papers 41

[92] ibid 1366; OECD, 'Algorithms and Collusion: Competition Policy in the Digital Age' [2017] < https://www.oecd.org/competition/algorithms-collusion-competition-policy-in-the-digital-age.htm> accessed 26 February 2023, 39

[93] OECD, 'Algorithms and Collusion – Note from the European Union' [2017] < https://one.oecd.org/document/DAF/COMP/WD(2017)12/en/pdf> accessed 26 February 2023, 9; Anne-Sophie Thoby, 'Pricing Algorithms & Competition Law: How to think optimally the European competition law framework for pricing algorithms?' [2020] 0009 Competition Forum < https://competition-forum.com/pricing-algorithms-competition-law-how-to-think-optimally-the-european-competition-law-framework-for-pricing-algorithms/> accessed 23 March 2023, 18

That said, would it be possible to hold exclusively the company liable? The issue here is that the company itself did not create the cartel. There are however examples where another entity is responsible for something or someone else's actions, that is 'vicarious liability'.[94] The liability of parents towards their children is an illustration of this mechanism.[95] Parents are (generally) responsible for damage committed by their child(ren).[96] Could a similar idea be established for algorithms?

This is not impossible but would require establishing a sort of 'causal link' between the algorithm behaving illegally, and the company using it. Allocating a 'shared accountability' between the company and the algorithm makes sense not only from a legal perspective, but also with regard to social responsibility: humans should monitor the algorithms they are using. More than that, a company should not be able to simply 'blame' their algorithms for anticompetitive conducts on the ground that it was the algorithm's doings and not their call.[97] This is especially true, in our view, when a company is making profit from the use of said algorithm.

The question then remains: how to establish a 'link' to hold an undertaking liable for using an algorithm which tacitly colluded with other autonomous algorithms? The two following sections try to provide an answer to this question.

SECTION 2. ALGORITHMS AS LEGAL PERSONS: THE LIABILITY WITHIN AN ECONOMIC UNIT

Thoby argues that attributing liability to algorithms *"appears in practice impossible as algorithms do not have any legal personality as physical persons and moral persons"*[98]. Yet, could the solution just be it: to grant legal personality to algorithms?[99] In a world where

[94] Daniela Glavaničová and Matteo Pascucci, 'Vicarious liability: a solution to a problem of AI responsibility?' [2022] 24 Ethics and Information Technology 27

[95] In most EU countries, parents exercise a joint responsibility. See for example in the Netherlands, Article 6:169 Burgerlijk wetboek; in Belgium, Article 1384(4) code civil; in France, Article 1384(4) code civil. In all EU countries, the mother has automatically a parental responsibility for her child. Your Europe, 'Parental responsibility' (*Your Europe, April 2022)* <https://europa.eu/youreurope/citizens/family/children/parental-responsibility/index_en.htm> accessed 13 May 2023

[96] Your Europe (n 95)

[97] Claudia Patricia O'Kane and Ioannis Kokkoris, 'A few reflections on the recent caselaw on algorithmic collusion' [2020] Competition Policy International Antitrust Chronicle < https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3665966> accessed 23 March 2023, 6

[98] Thoby (n 93) 18

[99] Alessio Azzutti, Wolf-Georg Ringe and H. Siegfried Stiehl, 'Machine Learning, Market Manipulation and Collusion on Capital Markets: Why the "Black Box" Matters' [2022] 43 U. Pa. J. Int'l L. < https://ssrn.com/abstract=3788872> accessed 26 February 2023, 127

algorithms are getting more sophisticated and thereby, closer to human capacities, the argument that they should be recognized a legal personality gains in credence.[100]

I. LEGAL PERSONALITY FOR ALGORITHMS

Whether algorithms should be granted a legal personality is questionable. On the one hand, it would facilitate liability imputability as it would impose obligations on the algorithm, including observing competition law rules. On the other hand, giving legal personality to algorithms might not be desirable. There are not only obligations, but also rights, such as the right to sue and be sued.[101] How can a computer program do so? The discussion around legal personality for AI has been ongoing for years now.

In 2020, the European Parliament issued three Resolutions on the ethical and legal aspects of AI, including one on a civil liability regime for AI.[102] The Parliament decided that "*it is not necessary to give legal personality to AI-systems"*[103]. It argued *inter alia* that granting legal personality would constitute a risk for liability, and that the Product Liability Directive should suffice, granted some modifications.[104] More recently, in 2022, the European Commission issued a proposal on an AI Liability Directive[105]. Aimed at providing a legal framework for liability claims for victims of damage cause by AI-enabled products and services, the question of legal personality is left out of the picture.

Conclusively, granting legal personality to algorithms to enhance liability does not seem to be on the agenda of the European Union. This view is, however, not unanimously followed. While the legal and ethical challenges around this topic are mainly accepted, some authors have argued that a special status reserved to AI should be enacted.[106] A new status of 'e-

[100] Simon Chesterman, 'Artificial Intelligence and the Limits of Legal Personality' [2020] 69 ICLQ 819
[101] European Commission, 'Commission Implementing Regulation (EU) 2018/1874 of 29 November 2018 on the data to be provided for 2020 under Regulation (EU) 2018/1091 of the European Parliament and of the Council on integrated farm statistics and repealing Regulations (EC) No 1166/2008 and (EU) No 1337/2011, as regards the list of variables and their description' C/2018/7861 OJ L 306, 16 (Annex I)
[102] European Parliament, 'Resolution of 20 October 2020 with recommendations to the Commission on a civil liability regime for artificial intelligence' (2020/2014(INL)) < https://www.europarl.europa.eu/doceo/document/TA-9-2020-0276_EN.html> accessed 25 March 2023
[103] ibid para 7
[104] ibid paras 7-8; Vagelis Papakonstantinou and Paul de Hert, 'Refusing to award legal personality to AI: Why the European Parliament got it wrong' [2020] European Law Blog < https://ai-regulation.com> accessed 22 March 2023
[105] European Commission, 'Proposal for a Directive of the European Parliament and of the Council on adapting non-contractual civil liability rules to artificial intelligence (AI Liability Directive)' [2022] COM/2022/496
[106] Robert van den Hoven van Genderen, 'Legal personhood in the age of artificially intelligent robots' in Woodrow Barfield and Ugo Pagallo, *Research Handbook on the Law of Artificial Intelligence* (Edward Elgar 2018) 213; Kateryna Militsyna, 'Legal Personhood for Artificial Intelligence: Pro, Contra, Abstain?' [2022] 122 Teisé 150; Papakonstantinou and de Hert (n 104)

personhood'[107] would enable algorithms to be held liable (for civil matters) while at the same time adapting rights and obligations to AI. Maybe surprisingly, the European Parliament had already made this suggestion in 2017 in its report regarding recommendations to the Commission on civil law rules on robotics.[108] It invited the Commission to further explore and analyse *"legal solutions, such as: f) creating a specific legal status for robots in the long run, so that at least the most sophisticated autonomous robots could be established as having the status of electronic persons responsible for making good any damage they may cause, and possibly applying electronic personality to cases where robots make autonomous decisions or otherwise interact with third parties independently".* Although the European institutions have for now opted out the legal personality for AI, the intermediary status of 'e-personhood' may still be a path to be explored.

All in all, debates on this issue are still ongoing and no consensus has been reached.[109] However, liability needs to be attributed at some point. The concept of legal personality, or more realistically, the *sui generis* status of e-personhood, should not be left out of the picture too quickly as it may facilitate liability imputability, at least from a competition law perspective. This is nonetheless the first step only. The second one is to establish the 'causal link' discussed in the first section. In that regard, the concept of 'economic unit' seems to be particularly of relevance.

II. ECONOMIC UNIT LIABILITY

At the EU level, an economic approach has been adopted to define the concept of 'undertaking'. It is defined as an 'economic unit', which can be composed of several personals, whether natural or legal.[110] The Court has ruled that an economic unit *"pursues a specific economic aim on a long-term basis and can contribute to the commission of an infringement of the kind in Article 101(1) TFEU"*[111]. It implies that a joint and several liability applies amongst

[107] Militsyna (n 106) 150
[108] European Parliament, 'Resolution of 16 February 2017 with recommendations to the Commission on Civil Law rules on Robotics' (2015/2103(INL)) < https://www.europarl.europa.eu/doceo/document/TA-8-2017-0051_EN.html#title1> accessed 13 May 2023, para 59
[109] See for example the diverging opinions in Roman Dremliuga, Pavel Kuznetcov and Alexey Mamychev, 'Criteria for Recognition of AI as a Legal Person' [2019] 12 J Pol & L 105; Chesterman, (n 100) 819; Papakonstantinou and de Hert (n 104)
[110] Judgment of 20 January 2011, *General Química and Others v Commission*, C-90/09 P, EU:C:2011:21, para 35; Judgment of 27 April 2017, *Akzo Nobel e.a. v Commission*, C-516/15 P, EU:C:2017:314, para 48; Judgment of 12 May 2022, *Servizio Elettrico Nazionale e.a.*, C-377/20, EU:C:2022:379, para 105
[111] Judgment of 1 July 2010, *Knauf Gips v Commission*, C-407/08 P, EU:C:2010:389, para 84-86; Judgment of 6 October 2021, *Sumal*, C-882/19, EU:C:2021:800, para 41

the entities of the same economic unit.[112] This is therefore interesting for our case as it means that when an algorithm and the company using it are considered as one economic unit, they share liability. More concretely, if the algorithm colludes, the company could be held liable. Accordingly, the question is: when can it be considered that they form an economic unit?

To determine whether two entities belong to the same unit, is relevant whether they can compete on the market. For competition to occur, *"each economic operator must determine independently the policy which he intends to adopt on the common market including the choice of the persons and undertakings to which he makes offers or sells"*[113]. If two legal entities are unable to compete, they are considered as one economic unit.[114]

There are different settings in which the Court has already recognized that two legal entities are unable to compete and are thereby part of the same economic unit. Two of those settings are studied here, namely the relationship of the employer/employee and of the parent/subsidiary.

A. ALGORITHMS: NEW EMPLOYEES?

It has been heavily suggested in the literature to recognize an algorithm as an employee.[115] Because an employee works under the 'direction' or 'control' of the company, the latter is responsible for the actions of its employee. *In casu*, this would mean that when an employee, i.e., the algorithm, is breaching Article 101 TFEU, the employer, that is the company using the algorithm, can be held liable.

The CJEU ruled in *Musique Diffusion française*[116] that for an undertaking to be held liable for its employees' actions, it is *"not necessary for there to have been action by, or even knowledge on the part of, the partners of principal managers of the undertaking concerned; action by a person who is authorized to act on behalf of the undertaking suffices*"[117]. This has been latter confirmed in *Slovenská sporiteľňa*[118]. According to the joint study of the French and German competition authorities, if we were to apply this ruling *mutatis mutandis, "an*

[112] *Sumal* (n 111) para 44; *Servizio Elettrico Nazionale e.a* (n 110) para 107
[113] *Suiker Unie* (n 59) para 175; Judgment of 4 June 2009, *T-Mobile*, C-8/08, EU:C:2009:343, para 32
[114] Okeoghene Odudu and David Bailey, 'The single economic entity doctrine in EU Competition Law' [2014] 51 Common Market Law Review 1726
[115] OECD, 'Algorithms and Collusion' (n 93) 9; Mihailis E. Diamantis, 'Employed Algorithms: A Labor Model of Corporate Liability for AI' [2022] 72 Duke Law Journal 797
[116] Judgment of 7 June 1983, *Diffusion Musique française v Commission*, C-100/80, EU:C:1983:158
[117] ibid para 97
[118] Judgment of 7 February 2013, *Protimonopolný úrad Slovenskej republiky v Slovenská sporiteľňa a.s.,* C-68/12, EU:C:2013:71, para 25

undertaking could be held liable simply for introducing and using an algorithm if that algorithm is authorized to take decisions regarding certain market behaviour, e.g. pricing" [119]. In addition, this solution would have the advantage that the degree of autonomy played by the algorithm would not be relevant *in casu*: all types of algorithms used by the undertaking could be caught under the notion of 'employee'.[120]

While this solution is full of promises, we express a caveat: the employee status seems to be fitting only for *natural* persons, which is a status reserved to human beings.[121] Nonetheless, if algorithms were to be granted a form of 'e-personhood' as discussed *supra*, it could be imagined establishing a similar employer/employee relationship, adapted once again to AI's specificities. This might constitute a good solution to hold the company accountable for the algorithm's (wrong)doings.

B. THE PARENT/SUBSIDIARY RELATIONSHIP

A second type of single economic unit is the parent/subsidiary relationship. The parent company wholly owns the subsidiary and exercises a legal control on the latter. Indeed, *"although having a separate legal personality, that subsidiary does not determine independently its own conduct on the market, but essentially carries out the instructions given to it by the parent company"*[122]. For these reasons, it can be argued that a parent and subsidiary cannot compete, and so, are part of a single economic unit.[123] Liability is not automatically incumbent on both parties but will vary depending on their respective direct participation to the infringement. However, the Court has established a rebuttable presumption of participation in the head of the parent company when it exercises decisive influence or control over the

[119] Autorité de la concurrence and Bundeskartellamt, 'Algorithms and Competition' [2019] < https://www.bundeskartellamt.de/SharedDocs/Meldung/EN/Pressemitteilungen/2019/06_11_2019_Algorithms_and_Competition.html> accessed 24 February 2023, 58-59

[120] ibid

[121] International Labour Office, 'Regulating the employment relationship in Europe: A guide to Recommendation No. 198' [2013] < https://www.ilo.org/wcmsp5/groups/public/@ed_dialogue/@dialogue/documents/publication/wcms_209280.pdf > accessed 24 March 2023; Odudu and Bailey (n 114) 1735; The Law Dictionary, 'Natural Person Definition & Legal Meaning' (*The Law Dictionary*) < https://thelawdictionary.org/natural-person/> acessed 24 March 2023; Legal Information Institute, 'Natural Person', *(Cornell Law School)* <https://www.law.cornell.edu/wex/natural_person> accessed 24 March 2023

[122] *Sumal* (n 111) para 43

[123] Judgment of 10 September 2009, *Akzo Nobel e.a. v Commission*, C-97/08, EU:C:2009:536, para 58; *Akzo Nobel e.a.*, C-516/15 P (n 110) para 52; *Sumal* (n 111) para 43; Okeoghene Odudu and David Bailey, 'The single economic entity doctrine in EU Competition Law' [2014] 51 Common Market Law Review 1728-1731

subsidiary.[124] In practice, this presumption is very difficult to overthrow as the parent company should prove that the subsidiary has acted in complete autonomy when infringing law.[125]

By analogy, it could be argued that an autonomous algorithm, if granted a form of legal personality, constitutes a subsidiary to the parent company using it. As the algorithm is initially programmed to maximize profits, it can be considered that it essentially carries out the instructions given by the parent company. Moreover, the parent company definitively can exercise control on the algorithm. Accordingly, the company could be held liable.[126]

Once again, this perspective would allow for accountability of the company, which is desirable. Yet, we argue that it is not self-evident that legal control derives from the fact that the company programs its algorithm to maximize profit. Once instructed maximalization goals, the algorithm is free to autonomously decide which strategy to adopt. The parent company could therefore rebut the presumption established by the Court and escape liability. Defining a benchmark for what is decisive influence or control is not easy. Establishing the moment where it can be considered that the algorithm starts to act independently will require a case-by-case analysis.

In addition, another issue needs to be addressed. The relationship parent/subsidiary is based on an ownership. Applied to our case, it means that the algorithm must be wholly owned by the company using it. However, not all companies develop their own algorithms, but often rely on third party companies which hold ownership rights of the software.[127] In that case, a relationship parent/subsidiary is impossible to establish. Should the owner be held liable then?

Authors such as Glavaničová and Pascucci have argued for a liability of manufacturers of AI machines (the owners in our case).[128] They base their suggestion on the fact that liability derives from the programmer, but as the latter acts as an employee of the manufacturer, liability should be borne by the manufacturer.[129] We argue that this proposal is unfit for algorithmic tacit collusion. As it will be explained in chapter 4 (section 1), programmers can most likely not prevent all collusive outcomes. Attributing liability to a third party, namely the programmer, or the manufacturer by extension, might be misplaced. Instead, we argue that, in case of

[124] Judgment of 25 March 2021, *Deutsche Telekom v Commission*, C-152/19 P, EU:C:2021:238, para 94; Judgment of 12 May 2022, *Servizio Elettrico Nazionale e.a.*, C-377/20, EU:C:2022:379, para 111
[125] Odudu and Bailey (n 114) 1751; Luca Calzolari, 'The Misleading Consequences of Comparing Algorithmic and Tacit Collusion' [2021] 6 European Papers 1217; Judgment of 29 September 2011, *Elf Aquitaine v Commission*, C-521/09 P, EU:C:2013:644, para 70-71
[126] Calzolari (n 125) 1218
[127] Ariel Ezrachi and Maurice E Stucke, 'Sustainable and Unchallenged Algorithmic Tacit Collusion' [2020] 17 Northwestern Journal of Technology and Intellectual Property 247-248
[128] Glavaničová and Pascucci (n 94)
[129] ibid 28

algorithmic tacit collusion, liability should be attributed to the user, i.e., the firm. A revision of the concept of 'parent/subsidiary', and in particular, of the ownership of the subsidiary, might therefore be necessary to ensure that liability can be attributed to the only entity capable of effectively preventing and addressing algorithmic tacit collusion, namely, the undertaking.

In conclusion, in a parent/subsidiary relationship, the liability is often shared, which is an advantage to hold companies liable for using colluding algorithms. However, there are two scenarios where the algorithm cannot be considered as a subsidiary: when the algorithm is not owned by the company, and where the algorithm is acting with such a degree of autonomy that there is no decisive influence or control exercised by the parent company.

III. INTERIM CONCLUSION

It is hard to evaluate whether an 'e-personhood' status will be adopted in the future. If it is, then the concept of economic unit is interesting to attribute liability. The relationship employer/employee has a more straightforward application so it might be easier to apply. However, labour law is mostly national so it might lead to a lack of uniformity in the Union. The parent/subsidiary relationship would not suffer from this as it is based on the definition of an economic unit, which an EU notion. Nonetheless, it is harder to apply due to the issues of (i) ownership and (ii) the criterion of decisive influence or control which requires a case-by-case analysis. If AI is never recognized legal personality, then it is necessary to explore other solutions which do not rely on a e-personhood status. This is analysed in the following section.

SECTION 3. AWARENESS: KEY TO ATTRIBUTE LIABILITY?

As explained *supra*, autonomous algorithms are left free to decide their maximisation strategy. What is important to understand is that algorithms have no rationale but simply execute what they have been programmed for. One of the most famous examples in that regard is the one of the book *The Making of a Fly*. Two sellers on Amazon used pricing algorithms which competed with each other. At its peak, the book reached $23,698,655.93 (and $3.99 shipping cost).[130] Algorithms achieve what makes sense from a mathematical perspective: they

[130]Andrew Couts, 'Why did Amazon charge $23,698,655.93 for a textbook?' (*DigitalTrends*, April 2011) <https://www.digitaltrends.com/computing/why-did-amazon-charge-23698655-93-for-a-textbook/> accessed 26 February 2023; Manon Van Roozendaal, 'Algorithms: teenage troublemakers of EU competition law. A closer look at algorithms as the new price-fixing tool in EU Competition Law' [2019] 1 *D.A.O.R.* 9

have no common sense, there is no 'right or wrong', nor is there an intent to adopt an anti-competitive practice. This is why humans need to keep monitoring their algorithms, no matter how complex they are. It is a duty of care and diligence. The proposed AI Act[131] and AI Liability Directive are built upon this idea and aim at ensuring monitoring and obligations for users and providers of AI systems. By analogy, and similar to the idea of compliance by design[132], what if a company could simply be held liable for the actions of its algorithm because it is its duty as user to ensure compliance with EU competition rules?

As explained in previous chapters, autonomous algorithms always tend to collude because it is the most advantageous economically. If it is certain that the algorithm will breach Article 101 TFEU, it could therefore be argued that the company has knowingly substituted the risk of competition by coordination from the start and can therefore be held liable. The key to attribute liability would thus reside in the fact that the company, while it has not instructed the algorithm to breach competition rules, is *aware* that it will probably do.[133] Hence, it is the company's responsibility to monitor the algorithm and ensure that the algorithm does not, in fact, reach collusion.

Awareness has already played a key role in the Court case law, and in particular in *Eturas*[134], the first case of algorithmic collusion. E-TURAS is a travel booking platform on which Lithuanian travel agencies can sell travel packages. Eturas and 30 travel agencies were accused of coordination after Eturas sent a mail (the 'message') to vote on a discount cap. The Court was asked whether *"the dispatch of a message […], may constitute sufficient evidence to establish that the operators which used the system were aware, or ought to have been aware, of the content of that message"*[135], amounting therefore to an indirect expression of their common intention to act on the market (by way of implied or tacit assent). The Court distinguished agencies for which it could be proven that they were aware of the content of the message, and those where such awareness could not be established. Summarizing, based on the *T-Mobile* presumption (where the Court established that when (i) there was a single meeting between competitors and that (ii) the undertakings concerned remained on the market, a causal

[131] European Commission, 'Proposal for a Regulation of the European Parliament and of the Council Laying Down Harmonised Rules on Artificial Intelligence (Artificial Intelligence Act) and amending certain Union legislative acts' [2021] COM/2021/206

[132] Margrethe Vestager, 'Algorithms and competition' (Bundeskartellamt 18th Conference on Competition, Berlin, 16 March 2017)

[133] Ariel Ezrachi and Maurice E Stucke, 'Artificial Intelligence & Collusion: When Computers Inhibit Competition' [2017] 2017 University of Illinois Law Review <https://papers.ssrn.com/abstract=3308859> accessed 26 February 2023, 1804

[134] Judgment of 21 January 2016, *Eturas e.a.*, C-74/14, EU:C:2016:42

[135] ibid para 29

link of concerted practice must be presumed)[136], the Court ruled that being *aware* of the message, and not distancing from it, was sufficient to establish a presumption of participation in the cartel.[137] Building upon this case law, and by analogy, it could therefore be argued that if humans are *aware* that their autonomous algorithm is achieving collusion, and did not oppose it, they should be held liable.

In addition, as there is (so far only experimental) evidence that autonomous algorithms *systematically* achieve collusion, and so breach Article 101 TFEU, it could be argued that a rebuttable presumption should be established where the use of autonomous algorithms amounts to a collusive practice. In that case, the burden of the proof would be reversed, and it would be for the undertakings concerned to prove that they have monitored their algorithm in a way as to prevent it for colluding. This would be advantageous for enforcers, as algorithmic tacit collusion is difficult to catch.

On the other hand, firms should have a real possibility to rebut the presumption. If they do not, not only might they get cold feet on using autonomous algorithms, which might deprive society from pro-competitive effects of AI (such as reduction of the costs, improvement of products and services, etc[138]), but it might also jeopardise fundamental rights such as the rights of defence and the presumption of innocence. If a presumption automatically applies when a firm uses an autonomous algorithm, it should be able to distance itself from the algorithm's action.[139] This requires to understand the algorithm's decision making, which is not always easy as complex algorithms can be seen as 'black boxes', resulting in "*the inability to either fully understand the AI decision-making process itself or assess the validity of its outcomes"*[140].[141]

Consequently, establishing a presumption of infringement as soon as a company uses an autonomous algorithm seems to be an unbalanced solution. What could be more fitting is recognizing that if a company was *aware or ought to have been aware* of its algorithm starting to collude but *did not act accordingly* on it in a *timely manner*, its liability is engaged. Liability should thus only be escaped when it was not foreseeable nor observable for the firm that its algorithm would reach/ is reaching tacit collusion.

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[136] Judgment of 4 June 2009, *T-Mobile*, C-8/08, EU:C:2009:343, para 53-62
[137] ibid para 42-46
[138] Giuseppe Colangelo 'Artificial Intelligence and Anticompetitive Collusion: From the 'Meeting of Minds' Towards the 'Meetings of Algorithms'?' [2021] 74 TTLF Stanford Law School Working Paper < https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3751255> accessed 26 February 2023, 10
[139] See by analogy *Eturas e.a.* (n 134) paras 38-40
[140] Azzutti, Ringe and Stiehl (n 99) 118
[141] ibid 122; Maurice E. Stucke and Ariel Ezrachi, 'Antitrust, algorithmic pricing and tacit collusion' in Woodrow Barfield and Ugo Pagallo, *Research Handbook on the Law of Artificial Intelligence* (Edward Elgar 2018) 644

This solution has for advantage that the burden of proof is not placed exclusively on enforcers. They would still have to prove that the company was aware or ought to be aware of the collusive outcome. To ease their burden, a similar solution to the Digital Markets Act (DMA)[142] could be considered, where competition authorities may request access to algorithms.[143] The DMA grants the Commission the power to conduct market investigations to detect (*inter alia*) unfair practices. Article 19(1) even adds that *"[…] the Commission shall take into account any relevant findings of proceedings under Articles 101 and 102 TFEU concerning digital markets […]"*[144]. In a second phase, the burden of proof would be reversed, and it would be for the company to prove that, if it was indeed foreseeable and/or observable, they acted accordingly on it, by restricting the algorithm to further collude. Otherwise, they can be held liable under Article 101 TFEU.

Summarizing, companies have duties of care and diligence. When they use autonomous algorithms, they are aware, or ought to be aware that collusion will most likely be achieved. When this is proven, their liability can be incurred if they have not acted in a timely manner to restore the situation pre-collusion and restrict the algorithm to further collude.

SECTION 4. CONCLUSION

The issue of liability regarding algorithmic tacit collusion stems from the problem that humans cannot be held liable for an anti-competitive conduct they have not committed, nor would it be possible to attribute the entire accountability to algorithms, as they cannot answer of it. It is therefore required to establish a link between the company and the algorithm. One way of doing so is by recognizing them as one undertaking, i.e., one economic unit, where liability is shared. However, it assumes that the algorithm is given a legal personality, which does not seem to be in European institutions' agenda. Another suggestion relies on the obligation for a user (the company) of an algorithm to monitor it and ensure compliance with competition rules. In case of awareness of anti-competitive conduct and non-action from the company, the latter could be held liable.

Attributing liability to AI is challenging, but not impossible. Legal clarification on this matter is needed to ensure legal certainty. So far, the EU legislative initiatives regarding AI

[142] Regulation (EU) 2022/1925 of the European Parliament and of the Council of 14 September 2022 on contestable and fair markets in the digital sector and amending Directives (EU) 2019/1937 and (EU) 2020/1828 (Digital Markets Act) [2022] OJ L 265/1
[143] ibid art 19(1) and 21(1)
[144] ibid art 19(1)

(such as the AI Act and AI Liability Directive) do not include competition law. Whether it should, is outside the scope of this paper, but in any case, clear liability rules should be established when an autonomous algorithm breach EU competition rules.

CHAPTER 4. REGULATORY ALTERNATIVES

The previous chapters have analysed whether Article 101 TFEU would be suitable to sanction algorithmic tacit collusion and hold a company liable for such a coordinated practice. It has been shown that there are still many challenges to this approach. For this reason, authors have turned to other instruments. These include, for instance, merger control[145], market investigations and sector inquiries[146], or enhanced transparency[147]. This thesis selected three regulatory alternatives for an exhaustive analysis: compliance by design (section 1), monitoring and reporting (section 2) and abuse of collective dominance under Article 102 TFEU (section 3). The reason for this selection is that (i) they are among the most discussed alternatives in literature and (ii) they all occur at a different time in the process: before the algorithm is placed on the market, during, and after infringement.

SECTION 1. EX ANTE: COMPLIANCE BY DESIGN

In her 2017 speech at the Bundeskartellamt conference, Margrethe Vestager declared that *"what businesses can – and must – do is to ensure antitrust compliance by design"*.[148] Since then, a lot of ink has been spilled on this proposal for compliance by design.

Also referred to as 'algorithms by design'[149] or a 'programming remedy'[150], and compared to the GDPR's mechanism of privacy by design and default[151], compliance by design

[145] OECD, 'Algorithms and Collusion: Competition Policy in the Digital Age' [2017] < https://www.oecd.org/competition/algorithms-collusion-competition-policy-in-the-digital-age.htm> accessed 26 February 2023, 41; Francisco Beneke and Mark-Oliver Mackenrodt, 'Remedies for algorithmic tacit collusion' [2020] 9 Journal of Antitrust Enforcement 171

[146] Ariel Ezrachi and Maurice E Stucke, 'Artificial Intelligence & Collusion: When Computers Inhibit Competition' [2017] 2017 University of Illinois Law Review <https://papers.ssrn.com/abstract=3308859> accessed 26 February 2023, 1806; Beneke and Mackenrodt (n 145) 172

[147] Alessio Azzutti, Wolf-Georg Ringe and H. Siegfried Stiehl, 'Machine Learning, Market Manipulation and Collusion on Capital Markets: Why the "Black Box" Matters' [2022] 43 U. Pa. J. Int'l L. < https://ssrn.com/abstract=3788872> accessed 26 February 2023, 130; Vasileios Tsoukalas, 'Should the New Competition Tool be Put Back on the Table to Remedy Algorithmic Tacit Collusion? A Comparative Analysis of the Possibilities under the Current Framework and under the NCT, Drawing on the UK Experience' [2022] 13 Journal of European Competition Law & Practice 239

[148] Margrethe Vestager, 'Algorithms and competition' (Bundeskartellamt 18th Conference on Competition, Berlin, 16 March 2017)

[149] Valeria Caforio, 'Algorithmic Tacit Collusion: A Regulatory Approach' [2022] Competition Law Review < https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4164905> accessed 26 February 2023, 14

[150] Tsoukalas (n 147) 238

[151] Pieter Van Cleynenbreugel, 'Article 101 TFEU's Association of Undertakings Notion and Its Surprising Potential to Help Distinguish Acceptable from Unacceptable Algorithmic Collusion' [2020] The Antitrust Bulletin 21

would ensure that algorithms are *"built in a way that doesn't allow them to collude"*[152].[153] This regulatory proposal would thus be operated *ex ante*: before algorithms are placed on the market, programmers have to forbid them to implement tacit collusion.[154] This raises several challenges.

The first challenge is of a technical order. Which exact features should programmers include (or not) in the algorithm to prevent it from colluding? As a reminder, autonomous algorithms have *not* been instructed to collude, but to execute a maximization strategy. They learn by trial-and-error, and continuously add data to a huge dataset. The French and German competition authorities describe it well when they say that algorithms are 'moving targets' which never stop to develop.[155] It would therefore seem very difficult, if not impossible, for a programmer to anticipate from the start, before the algorithm is placed on the market, which code would prevent the algorithm from colluding.[156] In other words, as programmers do not know – and cannot know – beforehand what the algorithm will learn based on which data, it is highly doubtful that it is technically feasible for them to prevent *all* collusive outcomes.

In addition, too strict technical restrictions might reduce algorithms' capabilities to adapt to the market and thereby, under-perform and lessen innovation.[157] Likewise, companies might be dissuaded to use such algorithms if they feel that they would not be able to ensure full compliance. Consequently, customers, and eventually consumers, would be deprived from the likely procompetitive effects of autonomous algorithms.

Finally, from an evidentiary perspective, compliance by design would be advantageous as it implies a reversal of the burden of proof. Indeed, it would be incumbent on the companies which have used an algorithm that has reached tacit collusion to prove that they programmed their algorithms – or only use algorithms which were programmed – in such a way that they have to avoid collusive outcomes.[158] However, what happens if the company has been compliant in the design of the algorithm but the latter still colluded? Caforio suggests than in this situation, the company can concretely see the consequences of collusion (for instance

[152] Margrethe Vestager, 'Algorithms and competition' (Bundeskartellamt 18th Conference on Competition, Berlin, 16 March 2017)
[153] To be exact, Margrethe Vestager's quote only referred to 'pricing algorithms'.
[154] Caforio (n 149) 15
[155] Autorité de la concurrence and Bundeskartellamt, 'Algorithms and Competition' [2019] < https://www.bundeskartellamt.de/SharedDocs/Meldung/EN/Pressemitteilungen/2019/06_11_2019_Algorithms_and_Competition.html> accessed 24 February 2023, 68
[156] Tsoukalas (n 147) 238
[157] Anne-Sophie Thoby, 'Pricing Algorithms & Competition Law: How to think optimally the European competition law framework for pricing algorithms?' [2020] 0009 Competition Forum < https://competition-forum.com/pricing-algorithms-competition-law-how-to-think-optimally-the-european-competition-law-framework-for-pricing-algorithms/> accessed 23 March 2023, 20-21
[158] Tsoukalas (n 147) 238

because supra-competitive prices have been established) and must thus act to restore the situation as it was pre-collusion (in our example, it would mean to reprice at a non-collusive level).[159] If it does act accordingly, its liability cannot be engaged. On the other hand, by refusing to restore the situation, the company can see its liability engaged.[160]

Caforio's proposal is, in our view, not optimal. The reason is twofold. First, considering that companies are always capable to identify tacit collusion might be utopic regarding the complexity of the functioning of autonomous algorithms. It is not to say that companies should escape liability in those situations, but a more balanced approach could be considered, because it might be too simplistic to expect that companies can always detect tacit collusion. For instance, it could be required from companies to show that they have taken all *reasonable measures* to detect and act against collusion. By doing so, the reversal of the burden of proof is maintained but companies can still prove that in a particular case, it was disproportional to detect tacit collusion created by their algorithm(s).

Secondly, compliance by design should constitute an incentive for firms to comply from the start with competition rules. According to Caforio's suggestion, the only difference between company A which has complied and company B which has not complied, but where both their algorithms reached collusion, is that company B may have to bear 'increased' fines, where company A would have mere 'fines'.[161] However, we argue that a simple increased fine might not constitute a sufficient deterrent for firms to comply by design. If they have not much to gain from complying, why would they? A strong deterrent must therefore be given. This might be found not in financial penalties, but in reputational sanctions. A reputational penalty represents *"the expected loss in present value of future cash flows due to lower sales and higher contracting and financing costs"*[162]. In their 2012 study, van den Broek and others calculated the loss occurred by a firm when there is the announcement of an antitrust investigation. Out of the total loss the firm supported in market value, they deduced that 33% of that loss was caused by reputational damage. This number drastically falls to 2.3% when the antitrust investigation is uncovered. From this study, they conclude that the most efficient deterrent for cartels is market-induced reputational penalties, and not fines imposed by the authorities.[163] In a more recent study focusing on media exposure, Mariuzoo, Ormosi and Majied confirmed that

[159] Caforio (n 149) 16-17
[160] ibid
[161] ibid
[162] Stijn van den Broek and others, 'The Reputational Penalties to Firms in Antitrust Investigations' [2012] 8 Journal of Competition Law & Economics 235
[163] ibid 231

reputational penalties act as a credible deterrent for cartels, while also acknowledging a greater role to public fines than van den Broek and others.[164] Accordingly, focusing on reputational penalties rather than mere fines could foster compliance by design.[165] We could therefore imagine a solution where company A, which has complied by design and proved that it adopted all reasonable measures to prevent and detect tacit collusion, is not held liable and so avoids reputational damage. This might constitute a sufficient, or at least stronger, deterrent for firms to comply in the first place.

In conclusion, while compliance by design is certainly a good idea in theory, it might not constitute a strong regulatory answer in practice. First, because it might be simply too difficult to program it when it comes to complex autonomous algorithms. Secondly, because a strong deterrent must be provided. Merely imposing a smaller fine on the firms which complied might not be sufficient (i) to prompt companies to comply in the first place and (ii) to encourage them from stopping collusion if and when they notice it. In order to encourage firms to use algorithms which have the ability to produce procompetitive effects, and to make compliance by design a more effective tool *ex ante*, we suggest that (i) firms should escape liability when they have proven that they adopted all reasonable measures to detect and prevent algorithmic tacit collusion, and that (ii) the focus should be on reputational penalties instead of fines as it might constitute a stronger deterrent for cartels. By doing so, companies would have more to gain to comply than not comply.

SECTION 2. INTER: MONITORING AND REPORTING

The previous section has underlined why it might be complicated – if not impossible – to prevent algorithms to collude by programming a prohibition *before* they are placed on the market. For this reason, it has been suggested that companies should ensure compliance with EU competition rules *while* using algorithms, by monitoring them and reporting in case of

[164] Franco Mariuzzo, Peter L Ormosi and Zherou Majied, 'Fines and reputational sanctions: The case of cartels' [2020] 69 International Journal of Industrial Organization 1

[165] As argued by Pieri, Moscianese and de Angelis: *"The heavy sanctionatory and reputational damage that may follow a violation of EU competition rules is duly taken into account by undertakings that have dramatically increased the investments in competition compliance"*. See Simone Pieri, Jacques Moscianese and Irene de Angelis, 'In-house Compliance of EU Competition Rules in Practice' [2014] 5 Journal of European Competition Law & Practice 69

infringement.[166] Namely, independently whether an algorithm has been designed to comply, what should only count is the practical observation of collusion.

This solution shares similarities with the 'risk management system' proposed in Article 9 of the AI Act draft[167]. This provision provides that for high-risk AI systems, *"[a] risk management system shall be established, implemented, documented and maintained"*[168]. More precisely, it consists in a *"continuous iterative process run throughout the entire lifecycle of a high-risk AI system, requiring regular systematic updating".*[169] Roughly, the 'known and foreseeable risks' must be identified and analysed, estimated, and evaluated, taking into considerations the 'conditions of reasonably foreseeable misuse', and suitable measures must be adopted when the risk is not deemed acceptable.[170]

Applied to our case, the approach would consist in the continuous monitoring of the algorithm's actions, and identification of the 'symptoms' of tacit collusion, also referred to as 'plus factors'[171], for instance when supra-competitive prices are adopted. This idea ties in with Caforio's argument according to which the concrete consequences of tacit collusion can always be identified, no matter how complex the algorithm.[172] Once the company has identified that the algorithm is colluding, it must report it to competition authorities and adopt measures to restore the situation pre-collusion. According to Deng, one of the advantages of this approach is that the focus is on the firm's observations and actions, and not on attempting to understand the black box.[173] Hence, firms cannot escape liability by advocating that their algorithm was simply too complex to understand.

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[166] Ezrachi and Stucke, 'Artificial Intelligence & Collusion' (n 146) 1806; Colm Hawkes, 'A Market Investigation Tool to Tackle Algorithmic Tacit Collusion: An Approach for the (Near) Future' [2021] 3 Research Papers in Law < https://www.coleurope.eu/sites/default/files/research-paper/ResearchPaper_3_2021_Colm_Hawkes.pdf> accessed 26 February 2023, 20

[167] European Commission, 'Proposal for a Regulation of the European Parliament and of the Council Laying Down Harmonised Rules on Artificial Intelligence (Artificial Intelligence Act) and amending certain Union legislative acts' [2021] COM/2021/206 hereafter referred to as the 'AI Act'.

[168] AI Act art 9(1)

[169] AI Act art 9(2)

[170] Jonas Schuett, 'Risk Management in the Artificial Intelligence Act' [2023] European Journal of Risk Regulation < https://www.cambridge.org/core/journals/european-journal-of-risk-regulation/article/risk-management-in-the-artificial-intelligence-act/2E4D5707E65EFB3251A76E288BA74068> accessed 22 April 2023 1-19

[171] *"Plus factors are economic actions and outcomes, above and beyond parallel conduct by oligopolistic firms, that are largely inconsistent with unilateral conduct but largely consistent with explicitly coordinated action"*, William E. Kovacic and others, 'Plus Factors and Agreement in Antitrust Law' [2011] 110:393 Michigan Law Review 393

[172] Caforio (n 149) 16-17

[173] Ai Deng, 'Algorithmic Collusion and Algorithmic Compliance: Risk and Opportunities' [2020] 27 The GAI Report on the Digital Economy 1011

Yet again, we express two main caveats. First, such a monitoring requires 'equipment' as Bernhardt and Dewenter put it, i.e., powerful tools and skilled staff.[174] When mentioning the competition authorities, they acknowledge that they generally have at their disposal well trained staff and modern technology.[175] However, what about the company itself which must detect the algorithm's behaviour? Is it not requiring from companies a too heavy financial investment?[176] Indeed, technology is known to be costly. Companies need to engage in costs of data, research, production, etc, but also the personnel.[177] Therefore, by requiring a constant monitoring, it is likely that SMEs will not be able to comply with such requirement, or at least will be disadvantaged compared to big (tech) companies which are able to invests billions in technology innovation and development.[178] For this reason, a more tailored approach should be adopted. One could imagine that similarly to the DMA[179] where gatekeepers (the larger online platforms) support additional obligations[180], larger enterprises should provide a stronger monitoring compared to SMEs. Typically, big firms operating in oligopolies (more prone to collusion), should bear an increased responsibility to engage into a proper monitoring of their algorithms.

Our second remark concerns the black box. It is true that companies do not need to fully understand the algorithm's decision making to observe its behaviour on the market. Nonetheless, companies need to understand how their algorithms reached collusion in order to restore the situation and to prevent it to adopt the same strategy next time. With black box algorithms, as it might be impossible to identify and/or explain algorithm's decision-makings, how can a programmer restore the situation as it was before collusion, if it does not understand it? And how can it be expected from a programmer to forbid the algorithm to use the same pattern the next time? It probably cannot, hence why a *continuous* monitoring is also required. We might therefore enter an endless loop where (i) the algorithm colludes, (ii) such behaviour

[174] Lea Bernhardt and Ralf Dewenter, 'Collusion by code or algorithmic collusion? When pricing algorithms take over' [2020] European Competition Journal 20
[175] ibid
[176] See also Ezrachi and Stucke, 'Artificial Intelligence & Collusion' (n 146) 1806
[177] Raul Incze, 'The Cost of Machine Learning Projects' (*Medium*, September 2019) < https://medium.com/cognifeed/the-cost-of-machine-learning-projects-7ca3aea03a5c> accessed 22 April 2023; Robert Coop, 'What is the Cost to Deploy and Maintain a Machine Learning Model?' (*phData*, May 2021) <https://www.phdata.io/blog/what-is-the-cost-to-deploy-and-maintain-a-machine-learning-model/> accessed 22 April 2023
[178] For example, Microsoft had spent over $4.5 billion to develop and operate Bing. See Maurice Stucke and Allen Grunes, *Big Data and Competition Policy* (Oxford University Press, 2016) 7
[179] Regulation (EU) 2022/1925 of the European Parliament and of the Council of 14 September 2022 on contestable and fair markets in the digital sector and amending Directives (EU) 2019/1937 and (EU) 2020/1828 (Digital Markets Act) [2022] OJ L 265/1
[180] DMA art 5

is identified, (iii) the programmer tries to restore the situation as it was before, but only for the algorithm to collude again, which takes us back to (i).

Conclusively, monitoring an algorithm's actions might be beneficial regarding enforcement since the consequences of collusion should be visible, and thus, detected by the company which must act on it accordingly. However, there is a risk that this constitutes a vicious circle, where the situation is fixed only temporarily, and that requiring constant monitoring from all companies might place a too heavy burden on companies, and especially on SMEs which might end up disadvantaged.

SECTION 3. EX POST: ARTICLE 102 TFEU TO THE RESCUE?

Considering the difficulties of catching tacit collusion under Article 101 TFEU (see chapter 2), it has been suggested that *ex post*, Article 102 TFEU could be applied to sanction an abuse of *collective* dominance. Under this provision, *"any abuse by one or* more *undertakings of a dominant position"*[181] is prohibited.

Regarding the notion of 'collective dominance', the Court had already ruled in 1992 in the *Italian Flat Glass* case (*SIV v Commission)*[182] that *"there is nothing, in principle, to prevent two or more independent economic entities from being, on a specific market, united by such economic links that, by virtue of that fact, together they hold a dominant position vis-à-vis the other operators on the same market"*[183]. In the landmark case *Compagnie Maritime Belge*, the Court clarified that it is not necessary for a collective dominance to flow from an agreement, but that it must be ascertained whether there are economic links or factors which induce a connection between the parties.[184] This collective dominance may significantly impede effective competition when the members of the dominant oligopoly, taking into account the market's characteristics, *"consider it possible, economically rational and therefore preferable to adopt the same policy on a lasting basis on the market with the aim of selling at above competitive prices"*[185]. The Court provides three cumulative conditions which must be met for

[181] art 102 TFEU
[182] Judgment of 10 March 1991, *SIV e.a. v Commision*, T-68/89, EU:T:1992:38
[183] ibid para 358
[184] Judgment of 16 March 2000, *Compagnie Maritime Belge Transports and Others v Commission*, C-395/96 P, EU:C:2000:132, paras 41-45
[185] Judgment of 13 July 2006, *Impala v Commission*, T-464/04, EU:T:2006:216, para 246, confirmed in Judgement of 10 July 2008, *Bertelsmann and Sony Corporation of America v Impala*, C-413/06 P, EU:C:2008:392, para 122. See also Judgment of 31 March 1998, *France et Société commerciale des potasses et de l'azote et Entreprise minière et chimique v Commission*, C-68/94, EU:C:1998:148, para 221

collective dominance to be found: (i) the market must be transparent enough and the parties must become aware of their interdependency, (ii) tacit coordination must be sustainable over time (which also implies that there must be no incentive to withdraw from the common policy) and (iii) the foreseeable reaction of competitors and consumers should not be able to jeopardise the results expected from such policy.[186]

Oligopolistic collective dominance is thus a concept which is substantially alike tacit collusion: the requirements to find collective dominance are very similar to those under which tacit collusion is likely to emerge. However, the same conditions (namely (i) a sufficient degree of transparency, (ii) sustainability and (iii) the absence of effective competitive constraints)[187] take place at two different moments under the two provisions. Under Article 101 TFEU, those conditions are the ones under which tacit collusion is expected to arise. It does not mean anything from an evidentiary perspective. One still needs to prove that there has been a mental consensus to knowingly substitute competition by practical cooperation (see chapter 2). On the other hand, the same conditions, if found under Article 102 TFEU, can establish collective dominance. When the conditions are met, a first step is thus already proven, that is dominance.

Also interesting is that the Court ruled in *Impala* that while the three conditions defined hereabove are necessary, the existence of a collective dominance may nevertheless be inferred, in the appropriate circumstances, *"indirectly on the basis of what may be a very mixed series of indicia and items of evidence relating to the signs, manifestations and phenomena inherent in the presence of a collective dominant position"*[188]. *In casu*, the *"close alignment of prices over a long period, especially if they are above a competitive level, together with other factors typical of a collective dominant position, might, in the absence of an alternative reasonable explanation, suffice to demonstrate the existence of a collective dominant position, even where there is no firm direct evidence of strong market transparency"*[189]. The Court therefore seems to leave the door open to a wide interpretation of collective dominance, which would be beneficial for cases of oligopolistic collective dominance since there is no direct communication or agreement between the algorithms.

While the theory is appealing, it is also likely that the Commission and the Court will adopt a cautious approach when applying this concept (to our knowledge, there has been no cases so far where oligopolistic collective dominance was applied). Indeed, although the *Impala*

[186] Judgment of 6 June 2002, *Airtours v Commission*, T-342/99, EU:T:2002:146, para 62; Judgment of 26 January 2005, *Piau v Commission*, T-193/02, EU:T:2005:22, para 111; *Impala v Commission* (n 185) para 247
[187] Richard Whish and David Bailey, *Competition Law* (Oxford University Press 2021), 592
[188] *Impala v Commission* (n 185) para 250
[189] ibid para 251

ruling provides a broad interpretation, it also comes close to a situation of parallel conduct.[190] From an evidentiary perspective, there is a thin line between collective dominance and parallel conduct, which the institutions will be careful not to overstep. This does not mean, however, that Article 102 TFEU would be valueless in case of algorithmic collective dominance. It is possible that the Commission and the Court will adopt a reasoning similar to concerted practice cases, where infringement is established only when it constitutes the only plausible explanation, and that the conduct at stake cannot be explained by other circumstances.[191] Despite those limitations, Article 102 TFEU remains interesting because, as provided *supra*, proving collective dominance only requires three conditions, that are generally required for tacit coordination to even emerge in the first place.

Be that as it may, only *abusing* a dominant position is prohibited under Article 102 TFEU. The first theory of harm that could fit in cases of algorithmic collective dominance is excessive pricing.[192] Indeed, it can be expected that in an oligopolistic context, autonomous algorithms will reduce output and set supra-competitive prices. Action could be taken against that type of practice. The Commission has traditionally taken a cautious approach regarding price regulation to avoid being a price regulator.[193] Nonetheless, the rise of algorithms and the risk they represent for the competition market might justify a greater presence from the European watchdog and the Court. This phenomenon is already to be observed in the pharmaceutical sector. Albeit competition authorities have traditionally been reluctant to intervene in excessive pricing cases, more action has been taken in the recent years, with *Aspen*[194] as the latest example.[195] Just as the pharmaceutical sector presents unique characteristics, it can be argued that the rise of algorithms in market competition also justifies greater attention and intervention from the authorities.

Besides excessive pricing, exclusionary practices, where competitors are excluded from the market or prevented to enter it, could also be useful.[196] Competition authorities could be

[190] See also Paolo Siciliani, 'Tackling Algorithmic-Facilitated Tacit Collusion in a Proportionate Way' [2019] 10 Journal of European Competition Law & Practice 34
[191] Judgment of 31 March 1993, *Ahlström Osakeyhtiö e.a. v Commission (Woodpulp)*, C-89/85 *et al.*, EU:C:1003:120, para 71; Judgment of 12 April 2013, *CISAC v Commission*, T-442/08, EU:T:2013:188, para 99
[192] art 102(2)(a) TFEU
[193] Elena Donini, 'Collusion and Antitrust: The Dark Side of Pricing Algorithms' (thesis, Università Di Bologna 2019) 42; Hawkes (n 166) 14; Whish and Bailey (n 187) 608
[194] *Aspen* (AT.40394) Commission decision 2021/C 435/04 [2021] OJ C 435 4
[195] Priyal Shukla, 'The Curious case of Aspen Pharmaceuticals and Excessive Pricing' (*European Law Blog*, 20 May 2021) < https://europeanlawblog.eu/2021/05/20/the-curious-case-of-aspen-pharmaceuticals-and-excessive-pricing/> accessed 15 May 2023; George Zacharodimos, 'Excessive Pricing' (*GCR*, 21 October 2022) < https://globalcompetitionreview.com/guide/guide-life-sciences/first-edition/article/excessive-pricing> accessed 15 May 2023
[196] Donini (n 193) 42

driven by the 'subversive' effect of new entrants on the market, that is that tacit coordination is less likely to be achieved since the oligopolistic interdependence is lessened, and therefore favour exclusionary conduct over exploitative abuse (and in particular, excessive pricing). Accordingly, there is a real possibility for tacit coordination to be sanctioned as an abuse of collective dominance. This must, in any case, be analysed on a case-by-case basis.

In conclusion, Article 102 TFEU might be applied to cases where algorithms hold a collective dominant position and abuse it. There seems to be a lower threshold from an evidentiary perspective, which is beneficial for enforcers. Whether a tacit coordination practice amounts to an abuse under this provision will require a case-by-case analysis, but Article 102 TFEU should be seen as an additional potential tool to sanction algorithmic tacit collusion.

SECTION 4. CONCLUSION

This chapter has explored other regulatory approaches than Article 101 TFEU to prevent and sanction tacit collusion by autonomous algorithms.

Ex ante, compliance by design and monitoring may constitute helpful tools if they are applied wisely. Regarding compliance by design, it is imperative that firms find an interest in complying and would be able to prove that they could not have avoided collusion having taken all reasonable measures. For monitoring, it might help increase compliance, but might prove to be too costly, especially for SMEs, and would only fix the situation temporarily. If implemented, it should ensure that SMEs are not disadvantaged in comparison to large companies. A combined approach of the two tools can therefore help to prevent and discourage collusion.

It is however unlikely that all collusive outcomes will be avoided. *Ex post*, the concept of 'abuse of collective dominance' under Article 102 TFEU can be a useful instrument. Taking into account the broad interpretation of the Court and the lower evidentiary threshold, it might be easier to prove collective dominance than collusion under Article 101 TFEU. Each case will require an individual assessment and different theories of harm might be applied.

In conclusion, none of the instrument alone is sufficient to answer to the problem of algorithmic tacit collusion. Taken together though, they might be useful tools to prevent, discourage and sanction algorithmic tacit collusion, provided that each one is carefully implemented.

CHAPTER 5. CONCLUSION

This thesis had as objective to analyse to what extent the current EU competition law framework can address algorithmic tacit collusion.

The **second chapter** focused on Article 101 TFEU, and more precisely, on the notion of 'concerted practice'. The reason thereof is that this notion does not require a proper agreement, meaning it is less onerous from an evidentiary perspective. A broad interpretation has been taken to analyse the conditions of 'concerted practice', namely there must be a mental consensus to knowingly substitute competition for practical coordination. Regarding the 'mental consensus', it is argued that since algorithms learn to decode each other based on their behaviour on the market, they are in fact disclosing their course of conduct, amounting to a form of indirect contact. Secondly, with regard to the knowingly substitute, it is considered that when algorithms exchange data, strategic uncertainty is reduced, which means that the risks of competition are being substituted by practical coordination. This broad interpretation has as advantage that it does not require regulatory alternatives: the main instrument for collusion in EU law is still used. On the other hand, this should not increase the number of false positives, where genuine parallel conduct is sanctioned. In addition, we argue that not any information exchanged should be considered as evidence of concerted practice. Rather, it should focus only on strategic information, that enable firms to determine their competitors' past and current actions. Lastly, recognizing that algorithms can actually determine each other's conducts on the market needs to be put to the test in real life markets, which are more complex than those created in experimental studies. From a theoretical perspective however, it is argued that overall, the notion of 'concerted practice' of Article 101 TFEU can be applied to algorithmic tacit collusion.

The **third chapter** had as objective to assess how liability could be attributed in cases of algorithmic tacit collusion. First, it has been established that a causal link is necessary to hold the company liable for its algorithm's actions. The first way to do so would be to assign to the algorithm a legal personality, so that it could be part of the same economic unit as the company. As this idea that has been rejected by the European institutions at the time being, it could be envisaged to create a *sui generis* status of 'e-personhood' for algorithms, where the right and obligations are more in line with the capabilities and essence of a computer software. By doing so, the algorithm and the firm could be considered as entities of the same economic unit. In the first setting, i.e., an employer/employee relationship, the algorithm acts as an employee under the direction or control of the firm which is responsible for its employees' actions. For now, the status of 'employee' is for natural persons only, but it could be modified as to include e-

personhood as well, thereby attributing liability on the firm for the algorithm's actions. Labour law is however mostly regulated at the national level so this solution might lack uniformity in the EU. The second setting is the parent/subsidiary relationship, where the subsidiary is an entity wholly owned by the parent company and where liability can be shared. However, it implies (i) that the algorithm is owned by the company, which is not always the case, and (ii) that the legal control exerted on the subsidiary derives from the mere programming of the algorithm for maximisation, which is questionable in our opinion. Accordingly, while the economic unit is a good idea on paper, it might be hard to implement. A second way of imposing liability has thus been explored, relying on the duties of care and diligence and on the awareness of autonomous algorithms systematically reaching collusion. It is argued that a rebuttable presumption could be established where the liability of the firm is engaged when it was aware or ought to have been aware of the collusive outcome, but did not act accordingly on it in a timely manner. Enforcers still have to prove that collusion was foreseeable and/or observable, but in a second time, a shift of the burden of proof is operated and the firm has to prove that it has prevented its algorithm to further collude and restored the situation pre-collusion. Before being implemented, some instruments might be considered to facilitate enforcers' evidentiary burden, but this solution is quite promising.

Finally, the **fourth chapter** analysed three regulatory alternatives which occurred at three different moments in time: before the algorithm is placed on the market (compliance by design), during (monitoring and reporting), and after the infringement has occurred (abuse of collective dominance under Article 102 TFEU). Compliance by design, where algorithms are built in a way that they are forbidden to collude, needs to consider that it is probably impossible for programmers to prevent all collusive outcomes. Companies should therefore have the possibility to escape liability when they can prove that they have taken all reasonable measures to avoid collusion. This would also avoid the cost of reputational damage which can act as a strong deterrent for companies. A constant monitoring may also help increase compliance, where firms must report if they noticed collusion and restore the situation as it was pre-collusion. Monitoring capabilities should be established depending on the size of the company: larger firms should bear increased obligations. We notice however that this solution is only temporary and cannot by itself prevent all collusive outcomes. Lastly, if collusion has indeed been reached, it is found that Article 102 TFEU can also sanction it on the ground of 'abuse of collective dominance'. Establishing collective dominance would require a low evidentiary threshold in the context of oligopolistic interdependence and the Court seems inclined to adopt a broad interpretation of this concept. This is the first step, as competition authorities will need

to find evidence of abuse of said dominance. Accordingly, Article 102 TFEU should be seen as an additional tool to sanction algorithmic tacit collusion.

This thesis had for main question: is algorithmic tacit collusion a threat to the current EU competition law framework? The **overall conclusion** is that, although algorithmic tacit collusion definitively questions some of the core principles of EU competition law, the current legal framework is capable, to some extent, of addressing this issue. This thesis analysed Article 101 TFEU, liability, and regulatory alternative as separate elements. However, some ideas overlap. It could therefore be imagined creating a regulatory answer which combines all these elements as one proposal. First, compliance by design should act as a first step to restrict collusive outcomes, as much as technically feasible (chapter 4, section 1). Because algorithms constantly learn with new data, a continuous monitoring should then be imposed, depending on the size and market importance of a firm (chapter 4, section 2). When a firm has proven that it has (i) complied by design and (ii) was not aware or could not have been aware of collusion despite a continuous monitoring, then it should escape liability (chapter 3, section 3). Otherwise, when awareness is established and the firm did not act on it accordingly in a timely manner, its liability can be engaged under the form of a concerted practice under Article 101 TFEU (chapter 2). Finally, if enforcers cannot prove that the firm has knowingly substituted competition for practical coordination, they can still rely on Article 102 TFEU to sanction an abuse of collective dominance (chapter 4, section 3).

With the rise of technology, there is no doubt that the questions explored in this thesis will become increasingly prominent. A proper technical understanding is required before implementing such a proposal. Nonetheless, the suggestions made in this thesis constitute a first basis to a regulatory answer to the issue of algorithmic tacit collusion. Because we need to make it clear that *"[w]e will not tolerate anticompetitive conduct, whether it occurs in a smoke-filled room or over the Internet using complex pricing algorithms"*[197].

[197] Interview with Bill Baer, 'Former E-Commerce Executive Charged with Price Fixing in the Antitrust Division's First Online Marketplace Prosecution' (April 2015) <https://www.justice.gov/opa/pr/former-e-commerce-executive-charged-price-fixing-antitrust-divisions-first-online-marketplace> accessed 13 October 2022

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