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Addressing Algorithmic Collusion in Competitive Markets: Article 101 TFEU Implications and Beyond

JAEM03 Master Thesis

European Business Law
30 higher education credits

Supervisor: Julian Nowag

Term: Spring 2024

Preface

This thesis embodies the last chords of my master's degree at Lund University. I want to express my deep and sincere gratitude to the Swedish Institute Scholarship for Global Professionals for making this enriching journey real and unforgettable.

I am beyond grateful to my university for all the knowledge and opportunities it has brought me. I specially thank to all my professors, especially my supervisor Julian Nowag for guiding me throughout this process.

I cannot pass by my family and best friends Aytan and Amil for always being there for me with their endless support.

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1. Introduction

1.1. Background

The increasing development of technology affects almost every part of the current economy. Now people can buy products online which was only possible at a brick-and-mortar store previously. With this in mind, algorithms have become important tools for businesses and have a crucial impact in competitive markets. It is true to say they are the bricks of companies for building their empires¹.

This evolving tendency brings both positives and negatives at the same time. Basically, the nature of algorithms and artificial intelligence (“AI”) depends on how they are employed, how markets are structured, and whether incentives of businesses align with society’s interests². We must be careful about the risks that this development brings us.

Businesses benefit from pricing algorithms to organize their price strategies better and quickly and with the support of these algorithms collusive outcomes can be achieved more easily. This means we are shifting from a world where undertakings collude in smoke-filled hotel rooms to a world where AI monitors and adjusts prices, over the Internet³. Communication is very important in this regard and if firms discuss about prices, this is not legal in most jurisdictions and this explicit talk is known as “the smoking gun in antitrust procedures”⁴.

Alongside the circumstances that can be foreseen by competition authorities, now there is a new threat – tacit collusion. With the introduction of pricing algorithms, we now may observe new forms of coordination that were not observed or possible before⁵. Algorithmic tacit collusion is currently beyond the total understanding of humans which might bring important and devastating results for the markets. This new phenomenon embodies the possibility of coordination without communication between undertakings.

¹ Catalina González Verdugo, 'Horizontal Restraint Regulations in the EU and the US in the Era of Algorithmic Tacit Collusion' (2018) University College London Journal of Law and Jurisprudence, 115-116

² Ariel Ezrachi, 'How Pricing Bots Could Form Cartels and Make Things More Expensive' (2016) Harvard Business Review <https://hbr.org/2016/10/how-pricing-bots-could-form-cartels-and-make-things-more-expensive>

³ Ariel Ezrachi and Maurice E. Stucke, 'Artificial Intelligence & Collusion: When Computers Inhibit Competition' (2017) University of Illinois Law Review vol 2017, no. 5, 1775-1776

⁴ Hans-Theo Normann and Miguel A. Fonseca, 'Explicit vs. Tacit Collusion – The Impact of Communication in Oligopoly Experiments' (2012) Working paper provided in cooperation with Düsseldorf Institute for Competition Economics, 1

⁵ Background Note by the Secretariat, 'Algorithms and Collusion' (21-23 June 2017), 16

Some might say it is not the firms, but algorithms reaching collusive outcomes. Even if humans only program algorithms to maximise profits and algorithms reach collusion tacitly among themselves to reach the specified aim, the responsibility of companies is emerging and disputed. From a welfare perspective, this is also problematic to make firms liable, due to its disadvantages that bring to consumers and the potential negative impact on innovation and economic growth⁶.

Since more firms use pricing algorithms, there is an emerging need to adjust the antitrust regulations⁷. Considering the threats algorithms can cause to markets and algorithmic collusion without an explicit agreement or direct communication falls outside the scope of Article 101 Treaty on the Functioning of the European Union (“TFEU”), the main question arises do we have enough remedies to address this and should algorithmic collusion be regulated under the current legal framework which is quite different from traditional explicit cartel agreements.

It is difficult to answer this directly because current legal tools are designed to deal with “human facilitation of parallel conduct” and new ways of coordination were not foreseen when prohibitions were fashioned⁸ many years ago. Since Article 101 includes agreements, concerted practices and facilitating practices, the question also raises whether algorithmic tacit collusion can be referred to as an agreement or a concerted practice.

Overall, we are face to face with improbable and extreme developments in the tech sector which may affect competition in markets and negatively impact consumers. In this regard, it would be appropriate to refer to Niccolo Colombo’s words: “That’s the progress baby! And there is nothing you can do about it. As we cannot stop it, we can at least try to critically assess it at a human pace”⁹.

We do not want to stop innovation, but let us assess what this innovation might bring us in the future and what we can do to fight against its negative consequences.

1.2. Purpose and Research question

Considering the ongoing discussions on pricing algorithms and algorithmic collusion, it is necessary to understand their positives and negatives in the economy to address the risks towards fair competition and consumer welfare.

⁶ John Weche and Thomas Weck, 'Tacit Collusion and the Boundaries of Competition Law: The Parallel Case of Common Ownership and Algorithmic Pricing' (2021) European Competition and Regulatory Law Review vol 5, no. 1, 4

⁷ Bruno Salcedo, 'Pricing Algorithms and Tacit Collusion' (2015) <https://brunosalcedo.com/docs/collusion.pdf>, 5

⁸ Michal Gal, 'Algorithmic-facilitated Coordination' (2017) 127th meeting of OECD Competition Committee, 15-16

⁹ Niccolò Colombo, 'Virtual Competition: Human Liability Vis-À-Vis Artificial Intelligence’s Anticompetitive Behaviours' (2018) CoRe; Berlin vol 2, Iss. 1, 23

My purpose in this thesis is to explore how algorithms shape current competitive markets and clarify ways to regulate them analyzing their two-sided effects.

A detailed understanding of this matter requires delving into the current legal framework of the European Union (“EU”) Competition law, mainly Article 101 TFEU. Because without evaluating the efficiency of current laws and regulations, it is not possible to determine whether algorithmic collusion can be adequately addressed and to identify any gaps and discrepancies. Even more extensive research is required when we speak about the integration of new forms of collusion, namely algorithmic tacit collusion into the old legislative framework.

By deepening the comprehension of current laws and role of pricing algorithms as critical tools for businesses, the pros and cons of integrating algorithmic collusion into the respective framework will be assessed in this thesis. I aim to evaluate how the current EU competition laws address algorithmic collusion and whether the existing framework is sufficient to tackle the modern challenges posed by these technologies. Given that tacit collusion is the most problematic form of collusion I will also analyse how it fits into the concept of concerted practice under Article 101 TFEU and how possible it is to deal with it.

Through detailed research, I seek to identify solutions to the potential future challenges that may arise from pricing algorithms in competitive markets. This includes answering what measures could be taken and which remedies might be effective in dealing with this emerging trend.

1.3. Methodology

One of the main methods of this thesis includes the qualitative method which contains non-numerical data that helps to understand different opinions and concepts. In qualitative studies, the focus is usually more on meanings than on the measurement of variables, more on depth, detail and sensitivity to context rather than generalizations¹⁰. With the help of this method, I developed new ideas and grasped a deep understanding of the respective research area. This method includes three approaches which are direct observations, in-depth interviews, and document analysis¹¹ and my focus on this thesis is document analysis.

With the descriptive research method, I also analysed the characteristics of pricing algorithms¹² and the phenomenons of algorithmic and algorithmic tacit collusion.

¹⁰ Frans L. Leeuw and Hans Schmeets, ‘Empirical Legal Research- A Guidance Book for Lawyers, Legislators and Regulators’ (2016), Available at: <https://doi-org.ludwig.lub.lu.se/10.4337/9781782549413>, p. 198

¹¹ Sharan B. Merriam, Elizabeth J. Tisdell, ‘Qualitative Research: A Guide to Design and Implementation’, 4th Edition (2015), p. 46

¹² Lee Epstein and Andrew D Martin, ‘Introduction to Empirical Legal Research Hardcover’, Oxford University Press (2014) p. 122

Then with a thorough literature review on the current framework of substantive law, mainly Article 101 TFEU and respective Regulations related to this subject I discussed what we have at hand to tackle with problems arising from algorithms in competitive markets.

I analyzed different experiments and studies done via algorithms to catch collusive outcomes and explored the case law to understand the interpretation of US and EU courts. With these all in mind, I aimed to search for suggestions from numerous authors to assess effective steps that can be taken now and in the future.

So overall, with legal, economic, technical, and policy perspectives and analytical thinking, I gained a comprehensive analysis of challenges that are likely to be posed by the collusion of algorithms and evaluated its integration into the current competition law framework by useful suggestions and recommendations.

1.4. Delimitations

My focus in this thesis is on the EU law framework, particularly Article 101 of TFEU along with considering the international aspects of the assessment and US case law.

While discussing algorithmic collusion, I analyzed only pricing algorithms that might have more impact on competition in markets and their effects on markets.

This thesis does not cover the detailed analysis of all forms of algorithmic collusion and four scenarios thoroughly. The central point includes analyzing all necessary risks that arise from algorithmic collusion with detailed research on the tacit type of collusion. In regard to the analysis of algorithmic collusion, I mainly focused on and discussed it under the concept of concerted practice.

1.5. Outline

On the way to discuss the question of this thesis, I start with extensive research on the main components of Article 101 TFEU in terms of the agreement and concerted practice and the burden of proof under that Article. This provides me with the ability to understand the main characteristics of these concepts and assess the possibility of addressing algorithmic collusion under those concepts later.

In the 2nd chapter, I focus on the overview of pricing algorithms and their effects on competition and consumer welfare. This helps to better focus and substantiate the (il)legality of this collusion while considering pro and anti-competitive effects.

The next chapter is aimed to discuss the collusive outcomes reached in competitive markets. How algorithms facilitate or reach collusive outcomes is demonstrated by analyzing different studies

and analytical evaluation. Different types of collusion and their presence in oligopolistic markets, as well as, four main scenarios where collusion is executed in different ways with the support of the relevant case law are reflected here. This raises attention to the red flags that we need to be very careful about. With a short overview of all collusion scenarios including practical examples to clearly understand the outcomes, I aim to establish the risks arising from algorithmic collusion with a special emphasis on tacit form. This discussion leads to the emergence of the discussion on analysing and extending the scope of Article 101 TFEU.

The 5th chapter embodies important challenges arising from the integration of algorithmic collusion into the respective framework, specifically its most controversial form- tacit collusion. Discussing the differentiation from parallel behavior, diving into the elements of the concept of concerted practice, particularly analyzing how tacit collusion of algorithms might fit under the concepts of “communication” and “intention”, investigating the liability concerns and its difficulty regarding proof and evidence requirements make me answer my research question effectively. After a detailed understanding of these parts, I clarify potential challenges and remedies that can be useful to tackle this concern in the next chapter.

Lastly, gaining profound knowledge on all relative parts of this extensive research, analyzing possible measures with the help of diverse literature help me to finish my research efficiently with understanding the major challenges and suggesting necessary steps for likely risks arising from algorithmic collusion.

2. Navigating the Legal Landscape: Provisions at Stake

2.1. Main components of Article 101 TFEU

The freedom of contract is the “cornerstone of free markets”¹³. However, the cornerstones also have limits. In the EU, Article 101 TFEU sets such limits to secure the effective functioning of markets.

The said Article prohibits all agreements between undertakings, decisions by associations of undertakings and concerted practices that may affect trade between Member States (“MS”) and have their object or effect to prevent, restrict or distort competition within the internal market. All such agreements, decisions and practices will be automatically void under paragraph 2 of this Article. Basically, the objective is to prohibit all forms of collusion that might limit competition¹⁴, because such anti-competitive acts leave a negative effect on consumer welfare¹⁵.

Three categories under Article 101 are intended to catch all forms of collusion that have the same nature that is distinguishable only by their intensity and the manifestation forms¹⁶. There are two main concepts that are relevant to this thesis: an agreement and a concerted practice.

It is beneficial to analyze these two concepts and their differences.

2.1.1. The scope of an “agreement”

An agreement includes a concurrence of wills between at least two parties, in a form that is unimportant as long as it constitutes “the faithful expression of the parties’ intention”¹⁷. The main part is a meeting of minds and a common strategy that undertakings involved employed¹⁸. The fact it is whether written or not is not important. The meaning of an expression is more important¹⁹. The expression must indicate the joint intention of undertakings to conduct in a specific way in the market²⁰.

¹³ Ana Poscic and Adrijana Martinovic, 'EU Competition Law in the Digital Era: Algorithmic Collusion as a Regulatory Challenge' (2020) EU and Comparative Law Issues and Challenges Series 4, 1031

¹⁴ Ibid

¹⁵ Rutger Claassen and Anna Gerbrandy, 'Rethinking European Competition Law: From a Consumer Welfare to a Capability Approach' (January 30, 2016) Utrecht Law Review vol. 12, no. 1, 1 (Available at SSRN)

¹⁶ Ana Poscic and Adrijana Martinovic, 'EU Competition Law in the Digital Era: Algorithmic Collusion as a Regulatory Challenge' (2020) EU and Comparative Law Issues and Challenges Series 4, 1031

¹⁷ Case T-41/96 Bayer v Commission [2000] ECR II-3383, para 69

¹⁸ Ilgin Isgenc, 'Competition Law in the AI ERA: Algorithmic Collusion under EU Competition' (2021) Trinity College Law Review 24, 36

¹⁹ Ibid

²⁰ F. Beneke and MO. Mackenrodt, 'Artificial Intelligence and Collusion' (2019) IIC 50, 112-113

In addition, it is important to note the concept of the agreement requires a “conscious commitment to a common scheme designed to achieve an unlawful objective”²¹. This means all parties involved intend and execute the common strategy with the aim of restricting competition. The important point is to discover the parties' true intent²². Also, the reason of this common conduct which infringes the existing or potential competition, and harms consumers is illegal under Article 101 TFEU²³ is because such agreements bring more profit than “any competitor would be able to gain through individual conduct”²⁴.

In other words, an agreement includes a plan that implies assurance of reliable future action²⁵ and requires proof of “direct or indirect contact showing that firms have not acted independently from each other”²⁶. Without such proof a presumption cannot be presumed and communication must be clearly defined in each case.

Finally, it is important to highlight not all similar actions indicate a conscious agreement. Some undertakings can react naturally to their rival's prices independently. Such independent conduct includes competitors acting without following others' actions and reactions and this does not constitute an agreement²⁷. This will be discussed in detail in chapter 5.

2.1.2. The concept of a “concerted practice”

A concerted practice is applicable in the absence of an agreement. In other words, this category aims to catch anti-competitive practices that cannot be deemed under both the concept of an agreement and a decision of an association of undertakings²⁸. This means if there is not an agreement between parties, this does not mean they can escape from the authorities' radar for their joint anti-competitive conduct.

In the *Suiker Unie* case²⁹, the Court of Justice of the European Union (“CJEU”) stated three criteria to find a concerted practice: first, there must be coordination, second, this coordination

²¹ *Monsanto Co. v. Spray-Rite Svc. Corp.* [1984] 465 U.S. 752

²² Ana Poscic and Adrijana Martinovic, 'EU Competition Law in the Digital Era: Algorithmic Collusion as a Regulatory Challenge' (2020) *EU and Comparative Law Issues and Challenges Series* 4, 1032

²³ *Ibid*

²⁴ *Ibid*

²⁵ A. Neale, *The Antitrust Laws of the United States of America* (2d edn, 1970), 88

²⁶ *Algorithms and Collusion*, Background Note by the Secretariat, *supra* note 22, at 17, 2017

²⁷ Michal Gal S., 'Algorithms as Illegal Agreements' (2019) *Berkeley Technology Law Journal* vol. 34, no. 1, 99

²⁸ Ana Poscic and Adrijana Martinovic, 'EU Competition Law in the Digital Era: Algorithmic Collusion as a Regulatory Challenge' (2020) *EU and Comparative Law Issues and Challenges Series* 4, 1033

²⁹ *Coöperatieve Vereniging "Suiker Unie" UA and Others v Commission of the European Communities* - Joined cases 40 to 48, 50, 54 to 56, 111, 113 and 114-73

should be a result of communication and third, the communication must aim to reduce uncertainties and change undertakings' behaviors³⁰.

Differently from the agreement, this practice requires a concertation, subsequent conduct on the market and a causal relationship between these two³¹. Regarding causation, the third requirement, there is a rebuttable presumption that can include distancing itself, reporting to the authority, or by other means³².

Concerted practices can be found in information exchange cases, discounts and price announcements and oligopoly situations³³ that will be discussed later. For example, signaling its own pricing strategies through algorithms may fall within the scope of this practice which was raised in the Container Shipping case³⁴. Here carriers announced the intended implementation date of the price increase some weeks before³⁵. Also in the Dyestuffs case³⁶, the European Commission (“EC” or “**Commission**”) sanctioned firms after finding them guilty of unlawful concerted practice for applying general and uniform price increases³⁷.

A concerted practice includes every form of coordination that has the effect of altering the conditions of the market and in this regard, according to the case law of the CJEU, “passive modes of participation in [an] infringement” can also be considered as indicative of collusion³⁸.

Overall, it is sometimes difficult to differentiate an agreement from a concerted practice, but it is not important which one is at stake if we are speaking about the prohibited anti-competitive action.

³⁰ Ilgin Isgenc, 'Competition Law in the AI ERA: Algorithmic Collusion under EU Competition' (2021) Trinity College Law Review 24, 36

³¹ F. Beneke and M.O. Mackenrodt, 'Artificial Intelligence and Collusion' (2019) IIC 50, 113

³² Francisco Beneke and Mark-Oliver Mackenrodt, 'Remedies for Algorithmic Tacit Collusion' (2021) Journal of Antitrust Enforcement, 157

³³ Beneke, F., & Mackenrodt, M. O. (2019). Artificial Intelligence and Collusion. *IIC*, 50, 113

³⁴ Alexander Stewart-Moreno, 'EU Competition Policy: Algorithmic Collusion in the Digital Single Market' (2020) York Law Review 1, 59

³⁵ Commission Decision of 7.7.2016 on Case AT.39850 Container Shipping

³⁶ Imperial Chemical Industries Ltd. v Commission of the European Communities - Case 48-69

³⁷ Jaime Eduardo Castro Maya, 'The Limitations on the Punishability of Tacit Collusion in EU Competition Law' (2018) Centro de Estudios de Derecho de la Competencia, 224

³⁸ Luca Calzolari, 'The Misleading Consequences of Comparing Algorithmic and Tacit Collusion: Tackling Algorithmic Concerted Practices Under Art. 101 TFEU' (2021) https://www.europeanpapers.eu/it/system/files/pdf_version/EP_eJ_2021_2_6_Articles_Luca_Calzolari_00519.pdf, 1208-1209

2.2. Burden of proof under Regulation 1/2003

While discussing the elements of Article 101 it is important to highlight the allocation of the burden of proof. Is it on the competition authority to prove the negative effects of the price fixing? Can the burden be shifted to the defendant?

Article 2 of Regulation 1/2003 clarifies the burden of proof for Article 101(1). Since Article 101(1) requires 'evidence to support the firm conviction'³⁹, according to Article 2 of Regulation, the burden of proving an infringement shall rest on the party or the authority alleging the infringement and the undertaking claiming the benefit of Article 101(3) bears the burden that the conditions set in that paragraph are fulfilled⁴⁰.

To determine liability the concertation should be established, for example, an undertaking participated in a meeting where an anti-competitive agreement was reached or participated in an exchange of information and in such a case, the burden of proof shifts to the undertaking to prove that it had no anti-competitive intention (for instance, it distanced from the discussion or its final conduct was not influenced by the received information)⁴¹. In *Woodpulp*, the Commission found evidence of the exchange of price information as a concerted practice and this judgment demonstrates how the burden of proof is on the Commission⁴².

For clarity, it is necessary to note that Article 101(3) sets exceptions from the liability. Such exceptions include all agreements, decisions and practices that contribute to the production or distribution of goods or to the promotion of technical or economic progress allowing consumers a fair share of the resulting benefit, and which do not impose indispensable restrictions and do not afford undertakings the possibility of eliminating competition.

However, for oligopolistic markets, it is difficult for authorities to set an adequate evidentiary standard for proving an agreement⁴³. Even in algorithmic tacit collusion cases, it is more challenging to prove the collusion. This also raises liability questions about whether this conduct can be imputed to the firms.

³⁹ Case T-67/00 *JFE Engineering v EC* [2004] ECR II-02501, para 57

⁴⁰ Council Regulation (EC) No 1/2003 of 16 December 2002 on the implementation of the rules on competition laid down in Articles 81 and 82 of the Treaty

⁴¹ Beneke, F., & Mackenrodt, M. O. (2019). Artificial Intelligence and Collusion. *IIC*, 50, 113

⁴² Jaime Eduardo Castro Maya, *The Limitations on the Punishability of Tacit Collusion in EU Competition Law* (2018) Centro de Estudios de Derecho de la Competencia, 226

⁴³ Catalina González Verdugo, *Horizontal Restraint Regulations in the EU and the US in the Era of Algorithmic Tacit Collusion* (2018) University College London Journal of Law and Jurisprudence, 130

3. The role and impact of price-fixing algorithms on competition

3.1. Price-fixing algorithms in the modern world

The role and impact of AI is considerable on businesses. Algorithms have changed the way companies set pricing strategies and interact. In this regard, for a better understanding of how these revolutions works, it is better to look into their definitions and effects in the literature.

An algorithm is a 'set of step-by-step instructions, to be carried out quite mechanically, so as to achieve some desired result'⁴⁴. It should be fed with information to produce a result⁴⁵ and a solution is used in the digital economy for the analysis and treatment of large amounts of data⁴⁶.

Undertakings like generating and instructing algorithms to set specific goals which make them save time and manpower. It is obvious that AI has "much to offer for businesses"⁴⁷. For example, it can observe and analyze codes of other algorithms, or learn the decisional parameters of its rivals⁴⁸. This means algorithms can comply with the codes of others and behaviors to reach their purpose. Basically, this can make them facilitate the collusive agreement or concerted practice.

There are different types of algorithms based on the tasks that they are appointed. Self-learning algorithms are referred to as "black box" algorithms, as their operation can be "incomprehensible, inexplicable and impossible to interpret, even to their creators"⁴⁹. These algorithms the concept of which is the replication of the human brain, can also find patterns a human would not detect⁵⁰. Such advanced development in technology can result in operators hiding behind the computer program⁵¹.

⁴⁴ Chabert, J.-L., & Barbin, E. (eds), *A History of Algorithms: From the Pebble to the Microchip* (Springer, 1999), 1

⁴⁵ González Verdugo, Catalina, 'Horizontal Restraint Regulations in the EU and the US in the Era of Algorithmic Tacit Collusion' (2018) *University College London Journal of Law and Jurisprudence*, 117-120

⁴⁶ John Weche and Thomas Weck 'Tacit Collusion and the Boundaries of Competition Law: The Parallel Case of Common Ownership and Algorithmic Pricing' (2021) *European Competition and Regulatory Law Review*, vol. 5, no. 1, 7

⁴⁷ Laura Hamdan, "Algorithmic Collusion: From Smokeroom to Code Lines? How Collusion Can Evolve & Are We Prepared." *Canadian Competition Law Review (CCLR)*, vol. 35, no. 2, Fall 2022, pp. 57-60.

⁴⁸ Michal Gal S. "Algorithms as Illegal Agreements." *Berkeley Technology Law Journal*, vol. 34, no. 1, 2019, pp. 80.

⁴⁹ Ana Poscic and Adrijana Martinovic. "EU Competition Law in the Digital Era: Algorithmic Collusion as a Regulatory Challenge." *EU and Comparative Law Issues and Challenges Series*, 4, 2020, pp. 1019-1021.

⁵⁰ Peter Georg Picht and Benedikt Freund, *Competition (Law) in the Era of Algorithms* (2018). Max Planck Institute for Innovation & Competition Research Paper No. 18-10, Available at SSRN: <https://ssrn.com/abstract=3180550>, P. 3-4

⁵¹ Ana Poscic and Adrijana Martinovic, "EU Competition Law in the Digital Era: Algorithmic Collusion as a Regulatory Challenge" (2020) 4 *EU and Comparative Law Issues and Challenges Series*, 1019-1021.

Regarding pricing algorithms, according to statistics, two-thirds of online retailers already use pricing tools⁵² and their specifications are written by humans⁵³. They let firms quickly update their pricing⁵⁴, so that they react faster to changes, and incur lower costs than humans⁵⁵. With their support, it is easier for businesses to monitor and adapt their conduct to the ongoing competition.

According to Ezrachi and Stucke, pricing algorithms raise special competition concerns, since they can both help competitors elude detection and can act as agents of collusion even without human intervention⁵⁶. It is not difficult to understand such concerns. Because pricing decisions are increasingly in the “hands” of algorithms and this can make collusive outcomes even more effective than humans⁵⁷.

When algorithms start following each other, this may result in higher prices and harm consumers. One of the best examples of this is the the book "The Making of a Fly" on Amazon the price of which reached up to 23 million dollars. This was the result of two algorithms following each other's conflicted codes⁵⁸. If you ask whether it was a first edition of Shakespeare, the answer is a big no, but yes both sellers used algorithmic pricing that made prices fly⁵⁹.

3.2. Effects on Market Dynamics

There are both positive and negative effects of price-fixing algorithms on competition and consumers.

I acknowledge and support the advantages of technology that help businesses to work more efficiently. However, the challenges these revolutions bring should be analyzed carefully. In this regard, the golden mean must be assessed well.

⁵² "Report from the Commission to the Council and the European Parliament: Final Report on the E-Commerce Sector Inquiry" (10 May 2017), para. 13

⁵³ Note by BIAAC On Algorithmic competition, 140th OECD Competition Committee meeting on 14-16 June 2023, 9

⁵⁴ Alexander Mackay & Samuel N. Weinstein, "Dynamic Pricing Algorithms, Consumer Harm, and Regulatory Response," Washington University Law Review (2022), 125

⁵⁵ Alexander Stewart-Moreno, "EU Competition Policy: Algorithmic Collusion in the Digital Single Market," York Law Review, 1 (2020), 55

⁵⁶ Ana Poscic and Adrijana Martinovic, "EU Competition Law in the Digital Era: Algorithmic Collusion as a Regulatory Challenge," EU and Comparative Law Issues and Challenges Series, 4 (2020), 1022

⁵⁷ Emilio Calvano, Giacomo Calzolari, Vincenzo Denicolò and Sergio Pastorello, "Algorithmic Pricing: What Implications for Competition Policy?," Available at SSRN: <https://ssrn.com/abstract=3209781> (2018), 1

⁵⁸ Abha Yadav and Tarun Donadi, "Tacit Collusion and Artificial Intelligence," Indian Journal of Artificial Intelligence and Law, vol. 1, no. 2 (2021), 21

⁵⁹ Laura Hamdan, "Algorithmic Collusion: From Smokeroom to Code Lines? How Collusion Can Evolve & Are We Prepared," Canadian Competition Law Review (CCLR), vol. 35, no. 2 (2022), 56

Let us discuss the most common and important concerns in this regard.

3.2.1. High transparency

If we speak about the Internet, it is obvious using algorithms increases market transparency. This transparency makes more information available for consumers including real-time prices and sales offers⁶⁰ decreasing search costs from seller's and buyer's perspectives. Consumers save time since they don't need to approach brick-and-mortar shops to compare prices and quality of products.

However, it is important to consider the cons of this increased transparency. Transparency can make coordination easier for competitors. This means one's decisional parameters and inputs can make others understand what drives their rivals' actions and make it easier to reach an equilibrium and limit rivals' actions that might lead to a price war⁶¹. In other words, when transparency is high, algorithms can read each other's mind and predict future actions⁶².

With high transparency, strong and clear signals are sent to other players. Such signals include the following factors important for coordination: decisional parameters on which the price will be set, frequency of searches for deviations, punishment for deviation⁶³. Frequency and decisional parameters are bases for starting a game because these are the main characteristics of catching and responding to signals. On the other hand, deviation includes the refrainment from common conduct. In the algorithmic world, if one algorithm refrains from the common strategy and deviates, it might be punished in return.

It is also important to note that transparency is not only a result of more available data but also of "the ability of algorithms to make predictions and to reduce strategic uncertainty"⁶⁴. They possess strong analytical and planning abilities which sometimes can be difficult for humans to understand. That's why algorithms can distinguish better than humans between intentional deviations and natural reactions to market condition changes⁶⁵.

To understand negative effects, an example of a recent study is considerable. Three economic studies have been conducted where petrol stations were required to post their prices online. This resulted in an increase in price, rather than lowering and ended in tacit collusion of stations.

⁶⁰ Ulrich Schwalbe, Algorithms, Machine Learning, and Collusion, (2019) Journal of Competition Law & Economics, 572

⁶¹ Michal Gal, Algorithmic-facilitated Coordination, 127th meeting of OECD Competition Committee on 21-23 June 2017, 5-6

⁶² Ibid 85-86.

⁶³ Ibid

⁶⁴ Ibid, 5-6

⁶⁵ Ibid

Specifically, the study in Germany showed that enhanced transparency could be the key for collusion since when one petrol station lowered the price by one cent at 11:33 A.M., within milliseconds other stations responded which even resulted in the competitors having less incentive to discount⁶⁶. This shows that the greater the price transparency exists, the quicker competitive responses will be, the less likely first-movers will benefit and the less likely price reduction will happen⁶⁷.

The EC has announced that increased price transparency can facilitate both tacit and explicit collusion by making detection of deviations easier and much more immediate⁶⁸. So considering both positives and negatives, it is true to say the transparency of prices is a ‘double-edged sword’⁶⁹, and the overall effect should be measured on a case-by-case basis.

3.2.2. Price discrimination

After analyzing concerns raised by transparency, we cannot pass by price discrimination. Price discrimination can be reached with a large amount of available data. The competitive effects of it are not certain, but we can consider consumers in this regard.

Prices can now be conditioned “not only on relatively innocent information such as the timing of the purchase, or the firm’s residual capacity but also on the buyer’s entire past purchasing history”⁷⁰. With this high level of transparency, consumers can end up with privacy issues⁷¹ that are undesired for them. In more depth, this can affect competition by giving opportunity some firms to better analyze their consumers’ preferences which others can lack. The possibility of individualized pricing has warned about competitive implications⁷². Maybe, this is controversial at the competition law point, but this does not change the risk of consumer harm.

There are also positives why price differentiation can be efficient and pro-competitive sometimes. It can increase output by offering lower prices “to less solvent buyers who could not afford to pay

⁶⁶ Note by Ariel Ezrachi & M. E. Stucke on Algorithmic Collusion: Problems and Counter-Measures, (2017) Directorate for Financial and Enterprise Affairs Competition Committee, 7-9

⁶⁷ Ariel Ezrachi and Maurice E. Stucke, "Artificial Intelligence & Collusion: When Computers Inhibit Competition," University of Illinois Law Review, vol. 2017, no. 5, (2017), 1792

⁶⁸ Ibid, 18

⁶⁹ Michal Gal, Algorithmic-facilitated Coordination, 127th meeting of OECD Competition Committee (21-23 June 2017), 5-6

⁷⁰ Emilio Calvano, Giacomo Calzolari, Vincenzo Denicolò and Sergio Pastorello, Algorithmic Pricing: What Implications for Competition Policy?, Available at SSRN: <https://ssrn.com/abstract=3209781> (2018), 2

⁷¹ Ibid

⁷² Nowag, J., & Cheng, T. K. (2023). Algorithmic Predation and Exclusion. University of Pennsylvania Journal of Business Law, 2023(1), 48-49

an average price”⁷³. Or if companies want to gain more long-term customers, they may charge wealthy consumers lower by offering attractive prices⁷⁴.

In the US, however, price discrimination is strictly forbidden. The Robinson-Patman Act prohibits charging customers different prices for goods⁷⁵. There have also been some cases regarding this, such as Amazon where it was caught price-discriminating against customers based on their browsing history⁷⁶.

3.2.3. Consumer harm

Consumer welfare is one of the most important principles under Competition law. In this regard, it is important to prioritize consumers while applying new mechanisms.

It is clear firms can employ pricing algorithms to raise prices at the first suitable situation⁷⁷. This may happen regularly when algorithms are coded with the purpose of profit-maximisation. To catch the pulse, other algorithms can follow their rivals’ actions and this may result in the decrease of incentives to discount and setting higher results which will result in consumer harm in the end. This harm to a consumer can be initiated by one firm employing a pricing algorithm and this algorithm may allow sellers to “extract a massive amount of wealth from consumers”⁷⁸.

Pricing algorithms can facilitate supra-competitive pricing in markets in two ways: first, they allow some firms to update prices much faster than others and the second way in which higher prices are achieved is “through a commitment to pre-specified pricing strategies”⁷⁹. At this point, we can remember the book “The Making of a Fly” example again. Imagine, you want to purchase a book and are required to purchase millions of dollars for it. It is not an exceptional original copy of a historical book with super high demand. Due to the pricing algorithms’ coordination, the price of this book rose dramatically and harmed consumers. This extreme example gives us “a foretaste of possible competitive dangers of price algorithms”⁸⁰.

⁷³ Peter Georg Picht and Benedikt Freund, Competition (Law) in the Era of Algorithms (2018). Max Planck Institute for Innovation & Competition Research Paper No. 18-10, Available at SSRN: <https://ssrn.com/abstract=3180550>, 10

⁷⁴ Ibid

⁷⁵ Alexander Mackay & Samuel N. Weinstein, "Dynamic Pricing Algorithms, Consumer Harm, and Regulatory Response," Washington University Law Review, (2022), 151

⁷⁶ Nowag, J., & Cheng, T. K. (2023). Algorithmic Predation and Exclusion. University of Pennsylvania Journal of Business Law, 2023(1), 48-49

⁷⁷ Alexander Mackay & Samuel N. Weinstein, "Dynamic Pricing Algorithms, Consumer Harm, and Regulatory Response," Washington University Law Review, (2022), 114

⁷⁸ Ibid, 111

⁷⁹ Ibid, 116

⁸⁰ Maik Wolf, Algorithm-Based Pricing in Online Retailing As Concerted Practice Covering the ‘Predictable Agent’ With Article 101 (1) TFEU (2019). Available at SSRN: <https://ssrn.com/abstract=3536959> , 5

3.2.4. Entry barriers

Last but not least, if we speak about the anti-competitive effects of algorithms, it is necessary to consider the threat of barriers to entry.

It must be noted algorithms can create entry barriers since colluding can lower prices when a new entrant wants to enter the market and make it hard to stay there⁸¹. For instance, colluding algorithms can quickly react to a new undertaking by lowering prices together which can result in a decrease in the new entrant's ability to gain market share⁸².

When entry barriers are high, reaching a supra-competitive equilibrium can be easier for some reasons: availability of real-time information, more accurate information on consumers' preferences, facilitation in data collection and increased connectivity capabilities in cyberspace⁸³.

⁸¹ Ilgin Isgenc, "Competition Law in the AI ERA: Algorithmic Collusion under EU Competition," *Trinity College Law Review*, 24 (2021), 35-54

⁸² *Ibid*

⁸³ Michal Gal, Algorithmic-facilitated Coordination, 127th meeting of OECD Competition Committee on 21-23 June 2017, 6

4. Collusive outcomes: A closer look at the collusion Scenarios

4.1. Overview of how algorithms facilitate collusion

It is true to say all advantages of algorithms are threatened by algorithmic facilitated coordination since they make coordination much easier and quicker than ever⁸⁴. There is no longer a need to meet in smoke-filled hotel rooms to reach a collusive outcome since pricing algorithms foster this and create new forms of anticompetitive conduct⁸⁵.

The collusion is defined as ‘actively conspiratorial behaviour of the kind captured by the expressions of agreement and concerted practices of Article 101’⁸⁶. This occurs when undertakings explicitly or tacitly execute a common strategy and fix prices on the supra-competitive level⁸⁷. A generic definition by the OECD also clarifies the definition. It is stated collusion refers to “combinations, conspiracies or agreements among sellers to raise or fix prices and to reduce output” to increase profits⁸⁸. This occurs when firms use strategies that encompass a reward-punishment scheme that rewards a firm for aligning with the supra-competitive price and punishes for departing from it⁸⁹.

Three-step process overviews the collusion: (1) communication and final conduct, (2) adoption of the common conduct, and (3) higher prices after coordination⁹⁰. These all steps take to the anti-competitive conduct in the market.

According to Airtours criteria⁹¹, collusion is likelier when undertakings reach common terms easily to start and maintain coordination and the three necessary criteria for this are as follows⁹²: firstly, parties should have the capacity to monitor co-conspirators, so deviations can be deduced, secondly, effective means of retaliation should be enforceable and thirdly, competitors and

⁸⁴ Ibid, 2-3

⁸⁵ Ariel Ezrachi and Maurice E. Stucke, "Artificial Intelligence & Collusion: When Computers Inhibit Competition," University of Illinois Law Review, vol. 2017, no. 5, (2017), 1809

⁸⁶ Richard Whish and David Bailey, Competition Law (8th edn, OUP 2015), 594

⁸⁷ Ilgin Isgenc, "Competition Law in the AI ERA: Algorithmic Collusion under EU Competition," Trinity College Law Review, 24 (2021), 37

⁸⁸ Ibrahim Abada & Xavier Lambin, Artificial intelligence: Can seemingly collusive outcomes be avoided? Available at SSRN: <https://ssrn.com/abstract=3559308> (2022), 26

⁸⁹ Ibid

⁹⁰ Timo Klein, "Autonomous Algorithmic Collusion: Q-Learning Under Sequential Pricing," RAND Journal of Economics (2021), 27

⁹¹ T-342/99, Airtours plc v Commission of the European Communities, Competition Regulation (2002)

⁹² Ioannis Kokkoris, 'The Development of the Concept of Collective Dominance in the European Community Merger Regulation. From its Inception to its Current Status', (2007), Vol.30, World Competition: Law and Economics Review, 423-424

customers should not be “in a position to threaten extra profits of collusive strategy”⁹³. Analysing these we can foresee how algorithms will “shape the future of collusive strategies”⁹⁴.

To understand the purpose of the collusive outcome, it is better to recall the famous Prisoners’ Dilemma. Here two accomplices of a crime were interrogated in different rooms, had no opportunity to communicate and needed to decide whether to confess and expose the other⁹⁵. In such a scenario, to be on the safest side it is better to coordinate and not to expose the other. In other words, in this classic game, the most profitable equilibrium strategy would be to both “cheat”⁹⁶. We observe the same when it comes to cartel participants. This contains crucial elements of competition, like the mutual interest in keeping high prices⁹⁷. It is also like a husband and wife would both choose a different activity but rather do something in the end together⁹⁸.

Algorithms can both be a result of the coordination and bring collusive outcomes tacitly without human intervention and planning. The need for communication, in other words, a meeting of minds is quite necessary here. However, algorithms have eliminated the need to explicitly communicate to maintain the said meeting of minds⁹⁹. In the literature, the main question is whether is algorithmic tacit collusion even possible. Some believe that there is a lack of evidence and such outcomes are unlikely to be learned by algorithms, however, the studies show this may occur after algorithms “decode” rivals’ algorithms¹⁰⁰ and when are programmed to maximize profits even if not given instructions about how to behave to reach the goal¹⁰¹.

The U.S. Department of Justice Antitrust Division official stated concerns about algorithms price fixing stem from “a lack of understanding of the technology”¹⁰². It is a real reason since we have no clear answers to such emerging risks. It is true to say that the joint conduct of algorithms is quite different- “harder to detect, more effective, more stable and persistent” and even though it is

⁹³ Ilgin Isgenc, "Competition Law in the AI ERA: Algorithmic Collusion under EU Competition," *Trinity College Law Review*, 24 (2021), 35-54

⁹⁴ *Ibid*

⁹⁵ Ai Deng, "What Do We Know about Algorithmic Tacit Collusion," *Antitrust*, vol. 33, no. 1 (2018), 89

⁹⁶ Ai Deng, "When Machines Learn to Collude: Lessons from a Recent Research Study on Artificial Intelligence," Available at SSRN: <https://ssrn.com/abstract=3029662> (2017), 3

⁹⁷ Emilio Calvano, Giacomo Calzolari, Vincenzo Denicolò and Sergio Pastorello, *Algorithmic Pricing: What Implications for Competition Policy?*, Available at SSRN: <https://ssrn.com/abstract=3209781> (2018), 13

⁹⁸ Alexander Stewart-Moreno, "EU Competition Policy: Algorithmic Collusion in the Digital Single Market," *York Law Review*, 1 (2020), 61

⁹⁹ Raghuvansh Seth, "Interplay of Algorithmic & Tacit Collusion with Competition Law," *NUALS Law Journal*, 16 (2022), 134

¹⁰⁰ Justin Johnson and D. Daniel Sokol, "Understanding AI Collusion and Compliance," Available at SSRN: <https://ssrn.com/abstract=3413882> (2020), 2-5

¹⁰¹ *Ibid*

¹⁰² Ai Deng, "What Do We Know about Algorithmic Tacit Collusion," *Antitrust*, vol. 33, no. 1, Fall 2018, 88

not clear how they reach a collusive outcome, it is likely they learn much faster than humans to reach a cooperative equilibrium eventually¹⁰³.

If we look at the study by ten researchers across four continents, the result is not all of the 25 algorithms learned to cooperate without communication¹⁰⁴. But it still indicates some have reached the collusive outcome which is our main concern in this thesis.

With the high development in this field, it is discussed that pricing algorithms can even “strengthen not only players' ability to reach an agreement but also their incentives to do so”¹⁰⁵. This is another concern.

4.1.1. Characteristics for distinguishing tacit and explicit collusion

Two forms of collusion are known in the practice: explicit and tacit collusion. They both have their distinct characteristics which are important to consider during the interpretation and assessment. Although this distinction is not specified in the law and there is a gap between antitrust practice and economic theory¹⁰⁶, it is necessary to discuss both and understand their differences.

Starting from explicit collusion, it is the type of collusion that is implicit and easy to understand the intention behind. Explicit collusion occurs when firms directly communicate with the coordination or monitoring intention to raise their profits and this is prohibited under Article 101¹⁰⁷. It is maintained with explicit agreements, regardless of whether they are written or oral and the most direct way to achieve it is a direct interaction and agreement on the price or output¹⁰⁸. In *Suiker Unie* case¹⁰⁹, the Commission established that even a plan is not required “provided there has been sufficient contact that could influence market conduct”¹¹⁰.

¹⁰³ Ibid.

¹⁰⁴ Ibid, 90

¹⁰⁵ Michal Gal S., "Algorithms as Illegal Agreements," *Berkeley Technology Law Journal*, vol. 34, no. 1 (2019), 89

¹⁰⁶ Hans-Theo Normann, Miguel A. Fonseca, "Explicit vs. Tacit Collusion – The Impact of Communication in Oligopoly Experiments," Working paper Provided in Cooperation with: Düsseldorf Institute for Competition Economics (2012) 1

¹⁰⁷ Michal Gal S., "Algorithms as Illegal Agreements," *Berkeley Technology Law Journal*, vol. 34, no. 1 (2019), 100

¹⁰⁸ Background Note by the Secretariat, "Algorithms and Collusion," 21-23 June 2017, 17

¹⁰⁹ Judgment of the Court dated 16 December 1975 on *Coöperatieve Vereniging "Suiker Unie" UA* and others v Commission of the European Communities. Joined cases 40 to 48, 50, 54 to 56, 111, 113 and 114-73

¹¹⁰ Alexander Stewart-Moreno, "EU Competition Policy: Algorithmic Collusion in the Digital Single Market," *York Law Review*, 1 (2020), 58

There have been few cases where explicit collusion was detected. For instance, Trod Ltd¹¹¹ was fined for colluding to fix prices with GB Posters on Amazon Marketplace¹¹². Then they began to employ third-party algorithms to lead the process and the communication further showed failures to adhere to the agreed common policy¹¹³. Finally, it was observed the supra-competitive equilibrium requirements were present and parties were penalised¹¹⁴. So we see the current legislation has adequacy to capture such cases under Article 101 to a wide extent¹¹⁵.

What about the tacit collusion of algorithms? Empirically, there is not an actual case we observe the assessment and proof. But this doesn't deprive us of insisting on a potential threat approaching the competition law framework that we need to be careful about its remedies. Considering some studies, certain algorithms can lead to reaching collusive outcomes and these are theoretical and experimental evidence that can also be reliable I believe. This type of collusion may happen under some market circumstances that will be discussed in the next sub-chapter.

When firms coordinate and monitor their actions without communication, this is referred to as tacit collusion and it is currently the main concern of antitrust authorities¹¹⁶. Tacit collusion is currently legal under EU competition rules. This means firms will not face any penalties, even though their conduct causes similar effects in the markets to explicit collusion¹¹⁷. This is very important because the same negative effects on competition are also observable. So that is quite risky since firms can even use algorithms "to achieve or enhance their collusion in an explicit collusion case"¹¹⁸.

The algorithm here replaces the competitors' intent and facilitates behavior that causes collusion and in such a scenario competitors unilaterally raise prices above a certain level in response to the behaviour of others without "any illegal agreement or even any contact or communication among the competitors"¹¹⁹. The reason this is not considered anti-competitive is that firms only behave with the goal of profit maximization¹²⁰. However, if a firm recognizes the collusive signal and

¹¹¹ 50223 Trod Limited and GB eye Limited, (2016), Decision of the Competition and Markets Authority

¹¹² Alexander Stewart-Moreno, "EU Competition Policy: Algorithmic Collusion in the Digital Single Market," York Law Review, 1 (2020), 57

¹¹³ Ibid

¹¹⁴ Ibid

¹¹⁵ Ibid, 80

¹¹⁶ Elena Parilina, Alessandro Tampieri, "Faking Patience with Tacit Collusion," International Game Theory Review Vol. 25, No. 2 (2023), 1-2

¹¹⁷ Luke Garrod, Matthew Olczak, "Explicit vs Tacit Collusion: The Effects of Firm Numbers and Asymmetries," International Journal of Industrial Organization (2017), 3

¹¹⁸ Catalina González Verdugo, "Horizontal Restraint Regulations in the EU and the US in the Era of Algorithmic Tacit Collusion," University College London Journal of Law and Jurisprudence, 2018, 116

¹¹⁹ Ana Poscic and Adrijana Martinovic, "EU Competition Law in the Digital Era: Algorithmic Collusion as a Regulatory Challenge," EU and Comparative Law Issues and Challenges Series, 4 (2020), 1023

¹²⁰ Abha Yadav and Tarun Donadi, "Tacit Collusion and Artificial Intelligence," Indian Journal of Artificial Intelligence and Law, vol. 1, no. 2, April 2021, 23

reacts by raising its price, tacit collusion can emerge without the need for explicit communication and due to the lack of explicit agreements, it is quite difficult to obtain evidence for its existence¹²¹.

I agree with the insight that tacit collusion can be the most challenging area for the competition law enforcement. Because although this is legal, it harms consumers as a hardcore price-fixing cartel to the same extent¹²² and is “the most complex and subtle way for companies to collude, without explicitly programming algorithms to do so”¹²³. Some researchers describe tacit collusion as “not an unconscious state” but analogous to a unilateral contract¹²⁴.

In *U.S. v Airline Tariff Publishing Co.*¹²⁵, players in the airline industry used different signals and mechanisms to sustain price-fixing collusion and attained this without the need for explicit coordination¹²⁶.

Ai Deng considers an algorithmic tacit collusion as an “invitation to collude” and sets three conditions to materialize: first, competitors should have the ability to decode other’s pricing algorithms, second, after decoding, the competitors should have the capacity to revise their own algorithms and third, firms should not be able to change or revise their algorithms very fast¹²⁷. The way it works is that a firm raises the price with the hope that others will interpret it as an invitation to collusion and respond by matching¹²⁸.

The Court was “reluctant to accept the possibility that Article 101 TFEU was applicable to tacit collusion”¹²⁹. *Woodpulp II* case, however, marked “a departure from the previous case law as it did not exclude the possibility that Article 101 could be applicable to tacit collusion”¹³⁰. After *Woodpulp II*, having a pricing algorithm that has certain characteristics can be treated as a plus

¹²¹ Niklas Horstmann and Jan Kraemer, "Tacit collusion of conglomerate firms through price signaling under multimarket contact" (April 17, 2016). Available at SSRN: <https://ssrn.com/abstract=2469452>, 4-6

¹²² Sumit Singh Bhadauria and Lokesh Vyas, "Algorithmic Pricing & Collusion; The Limits of Antitrust Enforcement," *Nirma University Law Journal*, vol. 8, no. 2, July 2019, 99-100

¹²³ "CIP Talks... Interview with Antonio Gomes of the OECD," *Antitrust Chronicle* (2017) Vol. 1, No. 2

¹²⁴ Alexander Stewart-Moreno, "EU Competition Policy: Algorithmic Collusion in the Digital Single Market," *York Law Review*, 1 (2020), 70

¹²⁵ *United States v. Airline Tariff Pub. Co.*, 836 F. Supp. 9 (D.D.C. 1993)

¹²⁶ Raghuvansh Seth, "Interplay of Algorithmic & Tacit Collusion with Competition Law," *NUALS Law Journal* 16 (2022) 143

¹²⁷ Ai Deng, "What Do We Know about Algorithmic Tacit Collusion," *Antitrust* 33, no. 1 (2018) 92

¹²⁸ Joseph Harrington, Working paper provided in cooperation with: Department of Economics, The Johns Hopkins University, "Signaling and tacit collusion in an infinitely repeated prisoners' dilemma" (2011) 2

¹²⁹ Catalina González Verdugo, "Horizontal Restraint Regulations in the EU and the US in the Era of Algorithmic Tacit Collusion," *University College London Journal of Law and Jurisprudence* (2018) 132-138

¹³⁰ *Ibid*

factor in helping tacit collusion¹³¹. Another plus factor is the exchange of information that can provide transparency that can lead to tacit collusion¹³².

The distinction between both types of collusion is not clear and this blurry line requires more clarity regarding the interpretation by competition authorities. It is straightforward to capture explicit collusion under Article 101 also relying on the case law practice. However, it is not simple in tacit collusion cases due to the lack of communication and form of explicit agreement.

Given that tacit collusion is not unlawful by itself, but may result in collusive outcomes it is not surprising how it brings new challenges. I suggest outlawing it after we have a sufficient understanding of its likelihood. However, outlawing this conduct is also pointless without suitable remedies that can address the social harm¹³³. Remedies that can be useful to tackle algorithmic collusion will be discussed in Chapter 6.

4.1.2. Oligopoly problem

Algorithmic collusion is mainly possible in oligopoly markets where there are few competing firms in the market. The oligopoly problem theory proposes competitors are interdependent meaning the actions of one are considered by others¹³⁴ and every firm's decisions have a considerable impact on its rivals and the market¹³⁵.

Interdependence means competitors are aware of each others' existence and adapt strategies "to achieve a stable non-competitive environment without the necessary incentives to compete"¹³⁶. Having homogenous products is one of the main oligopoly characteristics that makes the competition real. The other characteristics include higher entry barriers, market transparency, more stable demand and frequent and small purchases by customers¹³⁷.

From an economic perspective, firms play 'repeated games' here. This means players can analyse previous games to make next decisions¹³⁸. In other words, an oligopolist maximizes its profit by

¹³¹ Ibid

¹³² Ibid

¹³³ Francisco Beneke and Mark-Oliver Mackenrodt, "Remedies for algorithmic tacit collusion," *Journal of Antitrust Enforcement* (2021), 152

¹³⁴ Catalina González Verdugo, "Horizontal Restraint Regulations in the EU and the US in the Era of Algorithmic Tacit Collusion", *University College London Journal of Law and Jurisprudence* (2018) 121-22

¹³⁵ Michal Gal, Algorithmic-facilitated Coordination, 127th meeting of OECD Competition Committee on 21-23 June 2017, 5

¹³⁶ Catalina González Verdugo, "Horizontal Restraint Regulations in the EU and the US in the Era of Algorithmic Tacit Collusion", *University College London Journal of Law and Jurisprudence* (2018) 121-22

¹³⁷ Ai Deng, "What Do We Know about Algorithmic Tacit Collusion." *Antitrust* 33, no. 1 (2018) 92

¹³⁸ Catalina González Verdugo, "Horizontal Restraint Regulations in the EU and the US in the Era of Algorithmic Tacit Collusion", *University College London Journal of Law and Jurisprudence* (2018) 121-22

considering the reaction of its rivals¹³⁹. Prisoner's dilemma can be used as a metaphor to illustrate the strategies of oligopolists since two criminals committed a crime together and are offered a lighter sentence if testifies against the other, otherwise, each runs the risk of incurring a higher sentence¹⁴⁰. This game theory indicates both firms cheat and is applied to oligopolistic markets since players can choose between colluding and cheating regarding the pricing strategy¹⁴¹. Another example can be the retail petrol oligopoly markets in Germany, Chile and Australia. Here the Government mandated online price posting and real-time pricing obligations for firms that actually resulted in the facilitation of tacit collusion¹⁴².

To conclude, algorithmic collusion is facilitated in oligopolistic markets. Oligopoly includes when rivals' reactions are predictable, or firms' pricing algorithms can 'decode' each others' algorithms, thus letting better anticipate the other's reaction¹⁴³.

4.2. Collusion scenarios

After a detailed understanding of coordination, it is important to discuss how the collusion of algorithms can be executed in different scenarios which was qualified by Ariel Ezrachi. Some of them have been addressed under EU Competition law, but some have not been addressed yet due to the lack of evidence and remedies.

The analysis of these scenarios and understanding of differences is very important to detect collusive schemes and create ways to tackle them. Analyzing separately can help us to understand how to fight against them and clarify their anti-competitive effects and whether authorities may allow some collusive practices “to slip by for the sake of overall competitive gains or not”¹⁴⁴.

The presence of two important legal concepts is considered in the assessment: (1) evidence of intent and agreement, and (2) potential liability¹⁴⁵. For some, evidence is manageable and be collected by competition authorities easily just like traditional forms of explicit collusion. The liability issue also becomes clear that undertakings employ algorithms to execute their illegal plans. However, for some scenarios, evidence and liability are controversial. In this regard, for the

¹³⁹ F. Beneke, and MO. Mackenrodt. Artificial Intelligence and Collusion. IIC 50 (2019) 115-116

¹⁴⁰ Ibid

¹⁴¹ Ibid

¹⁴² Ashwin Ittoo and Nicolas Petit. Algorithmic Pricing Agents and Tacit Collusion: A *Technological Perspective*, Available at SSRN: <https://ssrn.com/abstract=3046405> (2017) 2

¹⁴³ Ariel Ezrachi and Maurice E. Stucke. "Sustainable and Unchallenged Algorithmic Tacit Collusion." *Northwestern Journal of Technology and Intellectual Property* 17, no. 2 (2020) 226.

¹⁴⁴ Ilgin Isgenc, "Competition Law in the AI ERA: Algorithmic Collusion under EU Competition." *Trinity College Law Review* 24 (2021) 35-54.

¹⁴⁵ Ariel Ezrachi and Maurice E. Stucke. "Artificial Intelligence & Collusion: When Computers Inhibit Competition." *University of Illinois Law Review* 2017, no. 5 (2017) 1782.

purposes of this thesis, it is important to differentiate all scenarios to clarify ways to deal with them.

Collusion scenarios include the Messenger Scenario, Hub and Spoke Scenario, Predictable Agent Scenario and Digital Eye Scenario.

I will start with the initial scenario.

4.2.1. Messenger Scenario

The first scenario is known as the simplest one. Here humans are decision-makers and form a purpose coding algorithms to execute this intention. In other words, undertakings collude traditionally and the point is to prove the illegal action in the market. So algorithms are only tools for executing their creators' will¹⁴⁶.

Firms employ algorithms together and use them as collusive devices which does not create a new competitive concern at all¹⁴⁷, so computers only assist in implementing, monitoring, and policing the cartel¹⁴⁸. Current legislative frameworks are well-equipped to deal with these cases and penalize these sorts of cartels¹⁴⁹. As clear we cannot speak about tacit collusion here that firms explicitly agree on the cartel.

The concept of agreement is applied straightforwardly from an enforcement perspective, and authorities, with enough evidence, will not have difficulty condemning the use of machines for the facilitation of collusion¹⁵⁰. To illustrate this, in a traditional cartel, executives agree on prices secretly, but here, after colluding in secrecy, they leave it to computer algorithms to enforce the agreement¹⁵¹.

¹⁴⁶ Ana Poscic and Adrijana Martinovic. "EU Competition Law in the Digital Era: Algorithmic Collusion as a Regulatory Challenge." *EU and Comparative Law Issues and Challenges Series* 4 (2020) 1024.

¹⁴⁷ Ulrich Schwalbe, *Algorithms, Machine Learning, and Collusion* (2019) *Journal of Competition Law & Economics*, 572

¹⁴⁸ Ariel Ezrachi and Maurice E. Stucke. "Artificial Intelligence & Collusion: When Computers Inhibit Competition." *University of Illinois Law Review* vol. 2017, no. 5 (2017) 1786-87.

¹⁴⁹ Abha Yadav and Tarun Donadi. "Tacit Collusion and Artificial Intelligence." *Indian Journal of Artificial Intelligence and Law* vol. 1, no. 2 (April 2021) 21.

¹⁵⁰ Ariel Ezrachi and Maurice E. Stucke. "Artificial Intelligence & Collusion: When Computers Inhibit Competition." *University of Illinois Law Review*, vol. 2017, no. 5, 2017, 1782.

¹⁵¹ *Ibid*, 1786-87.

Algorithms as executors have some levels of roles: firstly, they monitor data sent by others and react to generate supra-competitive price levels, secondly, they signal the behavior so others can take position accordingly, and lastly, they are designed in a way to punish the deviator¹⁵².

One example can be found in the Topkins case¹⁵³, where parties agreed to fix, increase and stabilize prices of some posters sold online on Amazon and to implement their agreement, they agreed to adopt a pricing algorithm to coordinate changes to their prices¹⁵⁴. They wrote a computer code instructing their software to set the posters' prices in conformity with their agreement¹⁵⁵.

As a result, the parties were found guilty and there was not enough counter-argument from their side. Attorney General Bill Baer later emphasized regardless of whether it occurs in a smoke-filled room or via the Internet anti-competitive conduct using complex pricing algorithms cannot be tolerated¹⁵⁶.

Although algorithmic pricing itself is not illegal and is a common practice, in the Topkins case, it was "the existence of an agreement to jointly implement the algorithm that made the case"¹⁵⁷. Topkins is the only competition case regarding algorithmic collusion which has been detected by a competition authority and resulted in prosecution. That's why this case plays an important role in the interpretation of algorithmic collusion cases.

Another similar example of the use of computers that facilitates collusion is the Airline Tariff Publishing case¹⁵⁸ where the defendant airlines used their online fare dissemination services to negotiate among themselves supra-competitive fares¹⁵⁹. This case also triggered an alarm for companies to be careful of their conduct.

Overall, we can observe algorithms in such scenarios play a secondary role¹⁶⁰ meaning they are programmed to follow the anti-competitive intent of undertakings. A simple test regarding the role of algorithms in Messenger scenario cases can be considered. Commissioner Maureen Ohlhausen

¹⁵² Ilgin Isgenc, "Competition Law in the AI ERA: Algorithmic Collusion under EU Competition," *Trinity College Law Review* 24 (2021) 35-54.

¹⁵³ *United States of America v. David Topkins* (2015)

¹⁵⁴ Ariel Ezrachi and Maurice E. Stucke, "Artificial Intelligence & Collusion: When Computers Inhibit Competition," *University of Illinois Law Review* vol. 2017, no. 5 (2017) 1786-87.

¹⁵⁵ Ariel Ezrachi, "How pricing bots could form cartels and make things more expensive," *Harvard Business Review* (2016) [Accessed: <https://hbr.org/2016/10/how-pricing-bots-could-form-cartels-and-make-things-more-expensive>]

¹⁵⁶ Dylan I. Ballard and Amar S. Naik, *ALGORITHMS, ARTIFICIAL INTELLIGENCE, AND JOINT CONDUCT*, [Accessed: https://www.sheppardmullin.com/media/article/1649_CPI%20-%20Ballard-Naik.pdf], 3

¹⁵⁷ Background Note by the Secretariat, *Algorithms and Collusion*, 21-23 June 2017, 27

¹⁵⁸ *United States v. Airline Tariff Pub. Co.*, 836 F. Supp. 9 (D.D.C. 1993) case

¹⁵⁹ Ariel Ezrachi and Maurice E. Stucke, "Artificial Intelligence & Collusion: When Computers Inhibit Competition," *University of Illinois Law Review*, vol. 2017, no. 5 (2017) 1786-87.

¹⁶⁰ Michal Gal S. "Algorithms as Illegal Agreements." *Berkeley Technology Law Journal*, vol. 34, no. 1(2019) 105.

suggested we can capture such cases as follows: “If the word "algorithm" can be replaced by the phrase "a guy named Bob," then algorithms can be dealt with in the same way as traditional agreements”¹⁶¹. So basically, if undertakings employ Bob, he can also execute the cartel just like an algorithm. It is not about algorithms functioning independently which will be the case in the third and fourth scenarios.

To conclude, considering the mechanism under this scenario, it is clear the algorithms only facilitate collusion initiated by undertakings and Article 101 clearly prohibits this by object¹⁶².

4.2.2. Hub and Spoke Scenario

The Hub and Spoke Scenario is not very different from Messenger regarding the evidence and liability parts. However, this is more indirect. Firms agree on a cartel agreement too, but with instructing the third party- Hub. In other words, several firms use the same algorithm by outsourcing their decisions to the third party acting as the hub that offers pricing as a service¹⁶³.

This common Hub can lead to horizontal concentration such as mutual dependence and is used to stabilise prices and decrease insecurities¹⁶⁴. As we discussed the role of intent in collusive behaviours, here too, the intent must be proved. To establish, authorities have to show that parties willingly entered into arrangements, and acted with all knowledge about the prohibited conduct or possible anticompetitive effects were known to them¹⁶⁵.

In this scenario, firms that lack advanced software teams use third-party algorithms to analyse the data and adopt dynamic pricing in real-time¹⁶⁶. We can see this framework in Uber. Drivers can be seen as Spokes and Uber as the hub. They don’t compete among themselves on price; some might want to offer a discount to clients, but Uber’s algorithm determines a base fare and how to impose a surcharge¹⁶⁷. Uber uses algorithms to set prices for rides by drivers analyzing the demand and

¹⁶¹ Ibid

¹⁶² Ilgin Isgenc, "Competition Law in the AI Era: Algorithmic Collusion under EU Competition." *Trinity College Law Review*, 24 (2021) 35-54.

¹⁶³ Ulrich Schwalbe, “Algorithms, Machine Learning, and Collusion” (2019) *Journal of Competition Law & Economics*, 573

¹⁶⁴ Ana Poscic and Adrijana Martinovic. "EU Competition Law in the Digital Era: Algorithmic Collusion as a Regulatory Challenge." *EU and Comparative Law Issues and Challenges Series*, 4 (2020) 1025.

¹⁶⁵ Ibid

¹⁶⁶ Abha Yadav and Tarun Donadi. "Tacit Collusion and Artificial Intelligence." *Indian Journal of Artificial Intelligence and Law*, vol. 1, no. 2 (2021) 22.

¹⁶⁷ Ariel Ezrachi, "How pricing bots could form cartels and make things more expensive," *Harvard Business Review* (2016) [Accessed: <https://hbr.org/2016/10/how-pricing-bots-could-form-cartels-and-make-things-more-expensive>]

supply at a specific time and area and these algorithms decide when to charge surge and normal pricing¹⁶⁸. This kills competition between drivers resulting in higher prices for customers¹⁶⁹.

In a traditional sense, spokes reach an agreement with the hub, and the hub is not a competitor on the horizontal level. Even if it is not the competitor, it embodies the intention of competitors which affects consumers. Spokes only use the hub as the indirect facilitator instead of reaching collusion among themselves¹⁷⁰.

Regarding the legality of this Scenario, the CJEU has clearly announced that all kinds of contact between competitors aiming to or leading to restriction of competition are prohibited¹⁷¹. This means that to use a third party and execute a cartel through it does not release undertakings from responsibility.

The best example of the Hub and Spoke scenario is found in the Eturas case. Here, several travel agencies appointed a booking system to execute the collusive behavior. Eturas, an online booking system, informed the travel agencies that the discounts they offer through that system would be monitored and should not exceed 3 percent and promptly amended the software to implement this measure¹⁷². This is actually a concerted practice as no agency was able to discount more than 3% for their customers¹⁷³. The Court held that agencies which were aware of the message would be presumed to have been involved in a concerted practice “unless they had distanced themselves from this conduct” and “absent further evidence and relying on the presumption of innocence—the mere sending of the message would not justify a presumption that the travel agencies ought to have been aware of the content of the message”¹⁷⁴. In other words, the Court stated, “in no uncertain terms that such behaviour would necessarily constitute a concerted practice under Article 101 if the travel agencies are found to not only be aware of the third-party intermediary’s messages and also failed to distance themselves away from the conduct in question publicly”¹⁷⁵.

¹⁶⁸ Abha Yadav and Tarun Donadi, "Tacit Collusion and Artificial Intelligence," *Indian Journal of Artificial Intelligence and Law* vol. 1, no. 2 (2021) 22.

¹⁶⁹ *Ibid*

¹⁷⁰ Ilgin Isgenc, "Competition Law in the AI ERA: Algorithmic Collusion under EU Competition," *Trinity College Law Review*, 24 (2021) 35-54.

¹⁷¹ *Ibid*

¹⁷² Francisco Beneke and Mark-Oliver Mackenrodt, "Remedies for algorithmic tacit collusion," *Journal of Antitrust Enforcement*, (2021) 157

¹⁷³ Abha Yadav and Tarun Donadi, "Tacit Collusion and Artificial Intelligence," *Indian Journal of Artificial Intelligence and Law*, vol. 1, no. 2 (2021) 22.

¹⁷⁴ Francisco Beneke and Mark-Oliver Mackenrodt, "Remedies for algorithmic tacit collusion," *Journal of Antitrust Enforcement*, (2021) 157

¹⁷⁵ Kenji Lee, "Algorithmic Collusion & Its Implications for Competition Law and Policy" (2018). Available at SSRN: <https://ssrn.com/abstract=3213296>, 25-26

One major concern was the identification that all agencies active in the system were involved in the concerted practice. Because the respective mail wasn't sent to all members and the Court ruled the agencies that were aware of are deemed to be part of the cartel "due to their inaction"¹⁷⁶. The reason was that even though their inaction, they never expressed their reservation publicly or distanced themselves from this practice and this suffices to establish a strong presumption of their tacit consent to concerted practice in the market¹⁷⁷.

It is clear from here that only those who were aware of the practice can be held liable for infringement. The CJEU highlighted that the technology by itself lacks the capability of infringing competition and the communication and consent of participants must be established¹⁷⁸. Overall, the main point was that the undertakings involved tacitly agreed on an anti-competitive action and the technology cannot violate Article 101 alone¹⁷⁹.

This is such an insightful case because the importance of spokes' knowledge of the concerted practice was highlighted so that as long as businesses are aware of the possible outcome, the "meetings of the mind" must be inferred¹⁸⁰.

Briefly concluding, Hub and Spoke scenario is a scheme where horizontal competitors employ a third party common for all to collude and the collusion agreement is executed through that Hub¹⁸¹. It is not very difficult to prove the intention of the involved parties and detect the Hub that was agreed upon in the beginning.

4.2.3. Predictable Agent Scenario

The third and more problematic Scenario is Predictable Agent. Here, there is no need for any human interaction and self-learning algorithms are the executors. What does this mean?

The self-learning algorithms can independently reach tacit collusion, without any intention or interference of their human programmers. In other words, competitors use algorithms capable of predicting rivals' future behavior and reacting to changed market conditions and there is no

¹⁷⁶ Abha Yadav and Tarun Donadi, "Tacit Collusion and Artificial Intelligence," *Indian Journal of Artificial Intelligence and Law*, vol. 1, no. 2 (2021) 22.

¹⁷⁷ Ana Posic and Adrijana Martinovic, "EU Competition Law in the Digital Era: Algorithmic Collusion as a Regulatory Challenge," *EU and Comparative Law Issues and Challenges Series*, 4 (2020) 1026-1027.

¹⁷⁸ *Ibid*

¹⁷⁹ Peter Georg Picht and Benedikt Freund, "Competition (Law) in the Era of Algorithms" (2018). Max Planck Institute for Innovation & Competition Research Paper No. 18-10, SSRN, 16-17

¹⁸⁰ Laura Hamdan, "Algorithmic Collusion: From Smokeroom to Code Lines? How Collusion Can Evolve & Are We Prepared." *Canadian Competition Law Review*, vol. 35, no. 2, (2022), 69-70.

¹⁸¹ Ilgin Isgenc, "Competition Law in the AI ERA: Algorithmic Collusion under EU Competition." *Trinity College Law Review*, 24, (2021), 35-54.

agreement here¹⁸². This means algorithms are the actual decision-makers. They see what's best for the undertaking and set supra-competitive prices that will be beneficial for all players¹⁸³.

Basically, an undertaking sends a signal by raising its price and depending on how others react, the collusion is either started or not¹⁸⁴. If others follow by raising their prices, the collusive strategy is reached¹⁸⁵. So it is a signal and response model, in cartel terms, offer and acceptance. As is clear, each unilaterally uses the computer as part of its strategy to enhance transparency and predict the behavior of its rivals¹⁸⁶. Others can both stay neutral and not react to the collusive signal and increase their pricing forming a non-formal cartel agreement.

The concept of the “agreement” is difficult to prove. But it suffices to say undertakings aim to reach tacit collusion and the non-existence of an agreement does not indicate that a meeting of minds did not occur, since firms act as if they are parties to the cartel agreement and expect others to uphold the scheme¹⁸⁷.

So if a firm increases its price in the expectation that others will respond, and if those others really respond and raise their prices too, such a behaviour can be understood as an offer. If the other firm catches the collusive price signal and reacts to it, tacit collusion can emerge without the need for explicit communication¹⁸⁸.

The best example of this model is the book "The Making of a Fly" discussed above. Algorithms followed each other and responded in turn to the other's actions which was not instructed by humans. In the end, a collusive outcome was reached by algorithms and resulted in excessive prices.

4.2.4. Digital eye Scenario

The last scenario is the Digital eye which is the most complex one and along with the previous scenario is my main focus while exploring tacit collusion. In some literature, it is considered “in

¹⁸² Ana Poscic and Adrijana Martinovic, "EU Competition Law in the Digital Era: Algorithmic Collusion as a Regulatory Challenge." *EU and Comparative Law Issues and Challenges Series*, 4, (2020), 1028.

¹⁸³ Abha Yadav and Tarun Donadi, "Tacit Collusion and Artificial Intelligence." *Indian Journal of Artificial Intelligence and Law*, vol. 1, no. 2, (April 2021), 22-23.

¹⁸⁴ Ilgin Isgenc, "Competition Law in the AI ERA: Algorithmic Collusion under EU Competition." *Trinity College Law Review*, 24, (2021), 35-54.

¹⁸⁵ Ibid

¹⁸⁶ Ariel Ezrachi and Maurice E. Stucke, "Artificial Intelligence & Collusion: When Computers Inhibit Competition." *University of Illinois Law Review*, vol. 2017, no. 5, (2017), 1789-90.

¹⁸⁷ Ilgin Isgenc, "Competition Law in the AI ERA: Algorithmic Collusion under EU Competition." *Trinity College Law Review*, 24 (2021), 35-54.

¹⁸⁸ Abha Yadav and Tarun Donadi, "Tacit Collusion and Artificial Intelligence." *Indian Journal of Artificial Intelligence and Law*, vol. 1, no. 2 (2021), 25.

the realm of science fiction”, however, considering the high development of new technologies, it is likely to become a reality soon¹⁸⁹.

To understand how this works, it is necessary to understand the special types of algorithms used to foster tacit collusion. This type is known as "black boxes to humans"¹⁹⁰ and they are obliged to find proper ways to realize and implement specific goals. At this point, it is not possible to detect any intent or action on purpose that can be deemed as collusion by humans. It is the final outcome of algorithms independently and humans can lack the control over how they reach to the coded purpose. Such cases are structured under the Digital Eye Scenario which is the trickiest one that raises many questions such as should this be illegalized under Article 101, if yes, can this outcome be imputed to the undertakings using self-learning algorithms and who bears the responsibility.

In simple words, in this scenario, profit-maximizing is coded as the ultimate aim and available data is fed into algorithms to determine the optimal pricing level to achieve the aim¹⁹¹. Human intervention is very limited and this role is mainly about defining the ultimate task and deciding on which datasets will be supplied¹⁹². After this point how an algorithm operates and how it finds the best solution is not always comprehensible¹⁹³. They end up with actions that can result in tacit collusion beyond the control of their developers and users and we cannot assume how much of their works “decided” to show us.

So this model is quite prone to tacit collusion. When it is a classic transparent case, we had to look into how the algorithm was coded in the beginning to detect collusion. Because when an algorithm does not go beyond the expected and planned conduct, then its activity is comprehensible and possible to clarify. However, this is not the case here. There is an unobservable nature of self-learning algorithms which makes the concept of responsibility very vague¹⁹⁴. A big concern is raised regarding the "black box" nature of those algorithms since they do not execute a task in a given way, but find the best solution meaning can fall outside the scope of undertakings' responsibility¹⁹⁵.

The legal concept of intent is completely removed because developers foresee tacit collusion as one of the possible outcomes- but not necessarily the likeliest so they are not motivated to achieve

¹⁸⁹ Ana Poscic and Adrijana Martinovic, "EU Competition Law in the Digital Era: Algorithmic Collusion as a Regulatory Challenge." *EU and Comparative Law Issues and Challenges Series*, 4 (2020), 1028-1029.

¹⁹⁰ Ibid

¹⁹¹ Ilgin Isgenc, "Competition Law in the AI ERA: Algorithmic Collusion under EU Competition." *Trinity College Law Review*, 24 (2021), 35-54.

¹⁹² Ibid

¹⁹³ Ibid

¹⁹⁴ Ibid

¹⁹⁵ Ibid

collusion¹⁹⁶. Undertakings only aim to increase their profits and proceed with algorithms and rely on them to realize the profit-centred aims. So tacit coordination is discussed as “not the fruit of explicit human design but rather the outcome of evolution, self-learning, and independent machine execution”¹⁹⁷.

The above-mentioned discussion raises red flags about the use of pricing algorithms in competitive markets and pushes us to clarify the activity of black boxes to avoid distortion of competition and catch such illegal conduct effectively.

¹⁹⁶ Ariel Ezrachi and Maurice E. Stucke. "Artificial Intelligence & Collusion: When Computers Inhibit Competition." *University of Illinois Law Review*, vol. 2017, no. 5, 1795.

¹⁹⁷ *Ibid*

5. Legal challenges of algorithmic collusion in the context of EU Competition Law

5.1. Challenges for the applicability

As clear from our discussion, algorithmic collusion is not specifically regulated by the existing laws and especially, tacit collusion as one of the forms of algorithmic collusion is also excluded from the scope of Article 101. Integration of these phenomena into the relevant scope can be realized with the extension of the concept of a “concerted practice”.

Considering all the threats it might cause to the competition in markets and for the purposes of my research question, the main question is to understand to what extent we can rely on current concepts to prevent new ways of anti-competitive conducts¹⁹⁸. In this regard, the recent challenges include but are not limited to the differing parallel behavior which is a natural reaction of competitors, the interpretation of algorithmic collusion under the scope of concerted practice, proof and evidence requirements that need to be completed to accuse under collusion and the imputability of liability in algorithmic collusion cases.

At this point, it is important to discuss these challenges and the effective measures to tackle them thoroughly. We can credit the words of Professor Thibault Schrepel that algorithmic collusion actually is an 'old wine in a new bottle', and the main principles of EU competition law will have to evolve eventually to deal with it¹⁹⁹. So in order to deal with algorithmic collusion, mainly its most complicated form of tacit collusion, an extensive analysis of the legal framework and discussing of discrepancies in law are a must.

5.1.1. Red line between parallel behaviour and algorithmic collusion

In this thesis, even though I support the discussion on outlawing algorithmic collusion to the extent possible to avoid potential negative effects of pricing algorithms on fair competition and consumer welfare, after collecting all necessary data regarding their activity and without negatively affecting innovation which will be elaborated later, this should not be understood that this idea includes the illegality of parallel behavior which is a completely legal and normal reaction of competitors in markets. Competitors are encouraged to achieve their economic interests and if their increasing

¹⁹⁸ Michal Gal S. "Algorithms as Illegal Agreements." *Berkeley Technology Law Journal*, vol. 34, no. 1, (2019), 98.

¹⁹⁹ Khan, Afif, and Shifa Qureshi. "Shikha Roy v Jet Airways: A New Approach to Algorithmic Collusion." *De Lege Ferenda*, vol. 5, no. 1, (2022), 92.

prices is not a part of an agreement, but “an immediate reaction to market circumstances”²⁰⁰, it is understandable that from a competitive perspective, this is quite normal.

However, it is important to see the distinct line between collusion and parallel behavior. The high risks of collusion and its potential negative effects on competition and consumer welfare are undeniable. But when it comes to parallel behavior, it is the natural reaction of competitors toward their rivals to keep the pulse of competition and sustain their positions without anti-competitive purposes. In other words, it is crucial to understand it is a legal state in a transparent environment where firms can track their rivals’ actions. Parallel behavior is a completely unilateral behavior, in other words, “independent reactions to common shocks”²⁰¹ and is not in the scope of the concerted practice under Article 101.

Undertakings have the right to adapt intelligently to the existing and anticipated conduct of their rivals, as long as they determine their policy independently²⁰². This means there should not be any contact between operators and there should not be any influence on the conduct of others²⁰³. So basically, every undertaking is free to change its prices without resulting in illegal coordination on purpose.

To give a practical scenario, if a company adjusts its prices as a result of intelligent market observation and this is its independent pricing strategy, this is permissible and European competition norms only sanction conduct that eliminates “the risk usually inherent in any independent change of conduct on one or several markets”²⁰⁴. It is understood competitors watch each other “like hawks” and each would copy or respond to its rivals without communicating and it is not a violation of antitrust law²⁰⁵.

It is quite difficult to differentiate these cases whether undertakings adapt to their competitors intelligently or they just act with the knowledge about their rivals’ conduct²⁰⁶. The main starting point to distinguish is independence.

²⁰⁰ Ana Poscic and Adrijana Martinovic. "EU Competition Law in the Digital Era: Algorithmic Collusion as a Regulatory Challenge." *EU and Comparative Law Issues and Challenges Series*, 4, (2020), 1028.

²⁰¹ Emilio Calvano, Giacomo Calzolari, Vincenzo Denicolò, and Sergio Pastorello, *Algorithmic Pricing: What Implications for Competition Policy?*, Available at SSRN: <https://ssrn.com/abstract=3209781>, (2018), 15

²⁰² Ana Poscic and Adrijana Martinovic. "EU Competition Law in the Digital Era: Algorithmic Collusion as a Regulatory Challenge." *EU and Comparative Law Issues and Challenges Series*, 4, (2020), 1034.

²⁰³ *Ibid*

²⁰⁴ John Weche and Thomas Weck. "Tacit Collusion and the Boundaries of Competition Law: The Parallel Case of Common Ownership and Algorithmic Pricing." *European Competition and Regulatory Law Review*, vol. 5, no. 1, (2021), 5.

²⁰⁵ Ariel Ezrachi and Maurice E. Stucke. "Sustainable and Unchallenged Algorithmic Tacit Collusion." *Northwestern Journal of Technology and Intellectual Property*, vol. 17, no. 2, (March 2020), 237.

²⁰⁶ Ana Poscic and Adrijana Martinovic. "EU Competition Law in the Digital Era: Algorithmic Collusion as a Regulatory Challenge." *EU and Comparative Law Issues and Challenges Series*, 4, (2020), 1034.

Kaplow highlights a clear-cut distinction between independent, interdependent behaviour and express agreement and notes these can lead to confusion if they are not defined well²⁰⁷. According to his words, interdependence falls within the scope of ‘agreement’ and this behavior involves coordination with others, and independent (parallel) behaviour is legal and is defined as ‘behavior by two or more parties that has similarities yet are motivated by considerations that do not depend on others’ reactions²⁰⁸.

If a firm would act in the same way regardless of its competitors' acting, this means there is no agreement and the defendants' actions were independent²⁰⁹. However, for instance, if each of the oligopolists wills to keep a higher price if its competitors charge the same prices, this behavior is clearly interdependent²¹⁰. In Sugar Ruling, the Court discovered "practical cooperation" that had the objective of influencing the behaviour of a competitor without limiting the term²¹¹. Also, the CJEU set forth in Dyestuff that even though parallel behaviour is not identified as a concerted practice, it may amount to strong evidence of this practice²¹².

Overall, we should be careful with the differentiation and remember that if prices are aligned by active reaction processes, eliminating spontaneous purchase decisions by consumers, it does not constitute legal autonomous parallel behaviour but constitutes forbidden coordination²¹³.

5.1.2. Tacit collusion as a concerted practice

Integrating algorithmic collusion into the scope of concerted practice is controversial. And when it is the case of tacit collusion, it is even much more controversial in literature. The reason is the concept of tacit collusion is “not fitting” to the current interpretation of a concerted practice.

If we want to illegalize this form of collusion specifically, this should be integrated into the scope of this practice. But it is not an easy process. We need to address elements of concerted practice directly such as communication and intention.

²⁰⁷ Catalina González Verdugo, Horizontal Restraint Regulations in the EU and the US in the Era of Algorithmic Tacit Collusion, University College London Journal of Law and Jurisprudence, (2018), 124

²⁰⁸ Ibid

²⁰⁹ Michael D. Blechman, "Conscious Parallelism, Signalling and Facilitating Devices: The Problem of Tacit Collusion under the Antitrust Laws." New York Law School Law Review, vol. 24, no. 4, (1979), 897-98.

²¹⁰ Ibid

²¹¹ Wolf Maik, Algorithm-Based Pricing in Online Retailing As Concerted Practice Covering the ‘Predictable Agent’ With Article 101 (1) TFEU, (November 22, 2019). Available at SSRN: <https://ssrn.com/abstract=3536959>, 13-14

²¹² Ibid, 132-138 and Judgment of the Court of 27 September 1988, A. Ahlström Osaakeyhtiö and others v Commission of the European Communities

²¹³ Ibid, 17

The first problem arises from the understanding of the concept of “communication”. The means of communication for cooperation is the main legal treatment of cartel agreements²¹⁴. Some insist algorithmic tacit collusion does not derive from direct or indirect communication and is unsustainable. They base on “experimental economics and the difficulty of sustaining tacit collusion under certain laboratory conditions”²¹⁵. Courts also require proof of express collusion in cases meaning sufficient evidence of an illicit communication and if this evidence is absent, the behaviour is deemed legal²¹⁶ which makes this concept difficult to prove.

If we agree when there is a lack of illicit communication, tacit collusion is impossible, then there is no need to worry. But is it really that simple just to say we can leave this because it is impossible? This is quite debatable due to the high transparency in online markets which can make cooperation possible. As discussed in one of the previous chapters, high transparency has a two-sided effect. First, consumers can compare available prices online and choose the one for their needs²¹⁷. Second, as a result of this increasing transparency, we may also lose the requirement of communication in markets.

Additionally, we cannot assume that traditional concepts will be applicable to newly developed notions, such as algorithms. Addressing this issue by the definition of communication does not seem effective since this tries to fit algorithmic collusion “into old judicial frameworks which do not sufficiently cover algorithmic collusion cases”²¹⁸.

It is important to look at the final outcome. Algorithms do not change the nature of illegal agreements, they only change the nature of the interaction, such as reaching an agreement, detecting deviations and creating a threat of retaliation for discouraging²¹⁹. And it is not the case of communication but the “very existence of collusion that harms competition” in algorithmic collusion cases²²⁰. So it is important to consider tacit collusion itself rather than looking for traditional methods of communication.

²¹⁴ Michal Gal S. "Algorithms as Illegal Agreements." *Berkeley Technology Law Journal*, vol. 34, no. 1, (2019), 98.

²¹⁵ Luca Calzolari, *The Misleading Consequences of Comparing Algorithmic and Tacit Collusion: Tackling Algorithmic Concerted Practices Under Art. 101 TFEU*, (2021), 1211. Available at [\[https://www.europeanpapers.eu/it/system/files/pdf_version/EP_eJ_2021_2_6_Articles_Luca_Calzolari_00519.pdf\]](https://www.europeanpapers.eu/it/system/files/pdf_version/EP_eJ_2021_2_6_Articles_Luca_Calzolari_00519.pdf)

²¹⁶ *Ibid*

²¹⁷ Ilgin Isgenc, "Competition Law in the AI ERA: Algorithmic Collusion under EU Competition." *Trinity College Law Review*, 24, (2021), 35-54.

²¹⁸ Ilgin Isgenc, "Competition Law in the AI ERA: Algorithmic Collusion under EU Competition," *Trinity College Law Review*, 24 (2021), 35-54

²¹⁹ Khan, Afif, and Shifa Qureshi. "Shikha Roy v Jet Airways: A New Approach to Algorithmic Collusion." *De Lege Ferenda*, vol. 5, no. 1, (2022), 92.

²²⁰ Ilgin Isgenc, "Competition Law in the AI ERA: Algorithmic Collusion under EU Competition," *Trinity College Law Review*, 24 (2021), 35-54

Already in the US, anti-competitive behavior can be coordinated sometimes without communication²²¹. Because basically a shared understanding is formed with no direct communication through potentially subtle and lawful signals²²². We would not exaggerate by saying depending on the characteristics of algorithms and how fast prices are changed, it can still be an information exchange case²²³. For this to fall within the scope, the information doesn't need to be exchanged directly, nor the communication among competitors is necessary and the main part is the information is available to the public, so competitors can access them²²⁴. However, the current scope of Article 101 is limited to reciprocal contacts between parties meaning this Article has “no teeth in situations of “pure” tacit collusion”²²⁵.

I believe tacit collusion can exist without any communication and pricing announcements can be deemed as communication that reaches competitors and customers. To demonstrate this, we can take a look at the study in 2012, where petrol stations in Chile were required to post fuel prices on a website and regularly keep prices updated²²⁶. A study found that this regulation did not increase competition and on the contrary, the stations' margins increased by 10% following the prices posted online²²⁷. So we see the increase in fuel prices is not the result of "communications" and instead, it likely reflects tacit collusion, where firms recognize they will profit by setting higher prices rather than discounting²²⁸.

In this regard, an expansion of the concept of “communication” can cover the first price increase signal and the response to it following that increase and this makes sense when we consider that they are designed to execute specific tasks²²⁹. So the decision of an undertaking for the collusive strategy strengthens the claim that “first price signaling is a cartel offer, hence communication”²³⁰.

²²¹ Ariel Ezrachi and Maurice E. Stucke, "Sustainable and Unchallenged Algorithmic Tacit Collusion," *Northwestern Journal of Technology and Intellectual Property*, vol. 17, no. 2, (March 2020), 232

²²² Alexander Mackay & Samuel N. Weinstein, "Dynamic Pricing Algorithms, Consumer Harm, and Regulatory Response," *Washington University Law Review*, (2022), 130

²²³ *Ibid*

²²⁴ Luca Calzolari, "The Misleading Consequences of Comparing Algorithmic and Tacit Collusion: Tackling Algorithmic Concerted Practices Under Art. 101 TFEU," https://www.europeanpapers.eu/it/system/files/pdf_version/EP_eJ_2021_2_6_Articles_Luca_Calzolari_00519.pdf, (2021), 1211

²²⁵ Catalina González Verdugo, "Horizontal Restraint Regulations in the EU and the US in the Era of Algorithmic Tacit Collusion," *University College London Journal of Law and Jurisprudence*, (2018), 138

²²⁶ *Ibid*

²²⁷ *Ibid*

²²⁸ *Ibid*

²²⁹ Ilgin Isgenc, "Competition Law in the AI ERA: Algorithmic Collusion under EU Competition," *Trinity College Law Review*, 24 (2021), 35-54

²³⁰ *Ibid*

On the other hand, the decoding ability of self-learning algorithms is also interpreted as a form of communication since regardless of the user's intent, these algorithms interact in their own language and can collude if they detect it as an optimal and profitable option²³¹.

Lastly, it is important to note if we cover tacit collusion under communication, we need to be very careful. Because this standing may "force undertakings to stay away from them" which can harm innovation and slow down developments²³².

Intention is another important element that is difficult to prove. Since algorithms do not have a mental state of "intent"²³³, this is an ongoing debate on how this can be linked. Some claim algorithms intend "to reach a certain goal by using a certain strategy" and this includes a coordinated equilibrium with other algorithms²³⁴. So intent can be encompassed.

But this also would not be unfair to hold computers with no brains liable and under such a difficult definition. This is fair when the intent is linked to a human- either its programmer or user. So if we do not want to go far, "the intent of the programmer to create coordination through the use of algorithms, and the intent of the user to employ such an algorithm" can fulfill this important requirement of intention, because the algorithm is only a tool that carries the coded purpose²³⁵. We understand algorithms are not created by themselves and this is humans that develop, code and use them with certain purposes for increasing their benefits.

Overall, it is crucial to clarify the ongoing debate on intention and communication and we need a clearer interpretation of these notions. Such clarification would not only reduce the uncertainty regarding understanding which practices are illegal and acceptable by helping businesses but also address some of the risks related to algorithmic collusion²³⁶. I believe, however, with a broader and clearer interpretation, tacit collusion can be addressed under the current EU competition law framework.

5.1.3. Challenges in proving and gathering sufficient evidence

Another challenge is proof and gathering evidence. This brings the challenge that in a case of algorithmic collusion, how does the competition authority gather sufficient evidence and prove this collusive outcome of algorithms and assess the responsibility issue?

²³¹ Ibid

²³² Ibid

²³³ Michal Gal S., "Algorithms as Illegal Agreements," Berkeley Technology Law Journal, vol. 34, no. 1 (2019), 107-109

²³⁴ Ibid

²³⁵ Ibid

²³⁶ Background Note by the Secretariat, "Algorithms and Collusion," 21-23 June 2017, 37

It is the Commission that has to show precise and consistent evidence to establish the existence of an infringement and when its reasoning is based on the supposition of the facts that cannot be explained other than by concentration between involved parties, it is for applicants to prove the facts established by the Commission “in a different light and thus allow another explanation of the facts to be substituted for the one adopted by the Commission”²³⁷.

Regarding the burden of proof rules under Regulation 1/2003, there are discussions that this can be addressed by shifting the burden to undertakings and imposing a duty to comply with guidelines and principles of compliance on them²³⁸. This can be in the form of the creation of an industry code of practice, that companies should follow when using algorithms and random inspections could increase deterrence and compliance²³⁹. However, even if we shift the burden to undertakings, technology can undermine the effectiveness of intervention since we already witness advanced, more complex algorithms that are very difficult to audit²⁴⁰.

5.1.4. Who is responsible?

During the discussion of algorithmic and algorithmic tacit collusion, it is important to consider the responsibility issue as well. So the main question is in both cases to whom the responsibility should be imputed: the algorithm itself, the programmer, or the undertaking who employs the algorithm? The main discussion is around the responsibility of competitors. Some insist that we cannot hold an undertaking liable for something “it did not intend to, it did not work for and it could not observe the whole mechanism of” in tacit collusion cases and the result achieved by the algorithm cannot be imputed to the undertaking unless the anti-competitive result was reasonably foreseeable²⁴¹.

It is true to say concepts of intent, fear, and “meeting of the minds” represent human mental states and they could not matter in dealing with computer software and hardware²⁴². However, with this in mind, we cannot justify collusions in markets that can result in a tremendous amount of consumer harm. In the very end, humans create and boost this technology so this issue cannot remain untouched by authorities assuming we do not have control so we are not responsible. So if

²³⁷ Ariel Ezrachi and Maurice E. Stucke, "Sustainable and Unchallenged Algorithmic Tacit Collusion," *Northwestern Journal of Technology and Intellectual Property*, vol. 17, no. 2, (2020), 235

²³⁸ Note by Ariel Ezrachi & M. E. Stucke on Algorithmic Collusion: Problems and Counter-Measures, (2017), Directorate for Financial and Enterprise Affairs Competition Committee, 23

²³⁹ Ibid

²⁴⁰ Ibid

²⁴¹ Nowag, J., & Cheng, T. K. (2023), "Algorithmic Predation and Exclusion," *University of Pennsylvania Journal of Business Law*, 2023(1), 76

²⁴² Salil K. Mehra, "Antitrust and the Robo-Seller: Competition in the Time of Algorithms," (2016), *Minnesota Law Review*, 1352

we look for an answer to whether a company is responsible when algorithms act in an unexpected way, it is important to remember the use of algorithms is “nothing more than the technical implementation of its own market presence”²⁴³. This responsibility issue has been clarified and formalized in some jurisdictions. For example, in the US, Algorithm Accountability Act holds the big tech companies liable for the activities of the algorithms and to understand the operation of them²⁴⁴.

On the other hand, we can interpret algorithms as the employees of a company in very simple terms. Since the conduct of employees is regarded as that of a firm and there is no independent significance under EU competition law, neither an employee’s decision on a certain issue nor the use of a pricing algorithm can release an undertaking from its responsibility²⁴⁵. According to the European Court of Justice, conduct can be “attributed to the contracting undertaking even if it could reasonably have foreseen it and was nevertheless prepared to accept the resulting risk”, so that a “meeting of algorithms” like the traditional “meeting of minds” appears dispensable now²⁴⁶. In other words, companies can assume the all outcomes that algorithms can reach which has been an ongoing debate for some years. So as European Commissioner Vestager stated, undertakings must know that when they decide to use a system automated, they can be held responsible for what that system does²⁴⁷.

Overall, it is important to understand humans are not out of the picture entirely and they are the actual ones picking and choosing which data to feed into the algorithm and telling it what data to look at²⁴⁸. Additionally, can we say all outcomes regarding the collusion regardless of it is explicit or tacit, for example, can result in the benefit of companies? So, they basically, would not care about potential threats of tacit collusion if not restricted and should be quite attentive regarding the use of pricing algorithms. Alongside this discussion, it has also to be admitted that the extent to which humans have control over algorithms is very important, but how real is it to detect this? All answers are difficult when a human does not direct the algorithm’s actions and this action is the result of so many intermediate steps of learning, which evolved from tons of data²⁴⁹. A possible

²⁴³ Wolf Maik, "Algorithm-Based Pricing in Online Retailing As Concerted Practice Covering the ‘Predictable Agent’ With Article 101 (1) TFEU" (2019). Available at SSRN: <https://ssrn.com/abstract=3536959> , 10-11

²⁴⁴ Abha Yadav and Tarun Donadi, "Tacit Collusion and Artificial Intelligence," *Indian Journal of Artificial Intelligence and Law*, vol. 1, no. 2, April 2021, 28

²⁴⁵ Wolf Maik, "Algorithm-Based Pricing in Online Retailing As Concerted Practice Covering the ‘Predictable Agent’ With Article 101 (1) TFEU" (2019). Available at SSRN: <https://ssrn.com/abstract=3536959> , 10-11

²⁴⁶ Ibid

²⁴⁷ Kenji Lee, "Algorithmic Collusion & Its Implications for Competition Law and Policy" (2018). Available at SSRN: <https://ssrn.com/abstract=3213296>, 39-43

²⁴⁸ Ariel Ezrachi and Maurice E. Stucke, "Sustainable and Unchallenged Algorithmic Tacit Collusion," *Northwestern Journal of Technology and Intellectual Property*, vol. 17, no. 2, (March 2020), 251

²⁴⁹ Ariel Ezrachi and Maurice E. Stucke, "Artificial Intelligence & Collusion: When Computers Inhibit Competition," *University of Illinois Law Review*, vol. 2017, no. 5, (2017), 1803

solution can be the imposition of liability when firms become aware of the illegal coordinative behavior among algorithms of rivals²⁵⁰. The burden of proof at this point looks challenging.

Some suggest a joint liability between programmers and companies can be an option too²⁵¹. However, I believe it can be time-consuming to analyze the scope of liability and clarify the extent between these two. On the other hand, programmers are more likely to contribute to the innovation meaning that it is quite controversial to hold them responsible alongside the main competitors. So it should be for companies to ensure that profitability is not achieved through algorithmic collusion and ensure algorithms do not provide “a back door for competitors to share sensitive information autonomously”²⁵².

Overall, I believe undertakings can be held liable for AI misconduct in the same way they are for human misconduct and perhaps this would even be more effective than human counterparts since AIs can be programmed on unlawful types of conduct²⁵³. Since humans can program and codify the conduct and the way algorithms will operate, this can be interpreted as firms are the ones having the decisive effect, so can be held liable in algorithmic collusion cases.

I understand the risks that this can bring regarding innovation and efficiency gains. Imposing liability for improper behavior of algorithms just the same as unlawful human conduct can limit their adoption and prevent producers and consumers from enjoying market efficiencies such as more efficient pricing²⁵⁴. Considering the discussion, it is accurate to assess both sides and decide on the most logical one for each particular case.

5.2. Addressing algorithmic collusion under Article 101 TFEU

As discussed above there are several aspects when it comes to integrating both forms of algorithmic collusion into the scope of Article 101. Regarding tacit collusion one aspect is that there is no need for illegalization, since it is out of the control of developers and users. And algorithms engage “in cold, profit-maximizing calculations” meaning since they are “less likely than humans to trust one another, maybe they’re less likely to collude, too”²⁵⁵. In addition, concepts

²⁵⁰ Ibid

²⁵¹ Background Note by the Secretariat, "Algorithms and Collusion," 21-23 June 2017, 38

²⁵² Ai Deng, "What Do We Know about Algorithmic Tacit Collusion," *Antitrust*, vol. 33, no. 1 (2018) 93-94

²⁵³ Dylan I. Ballard, Amar S. Naik, "Algorithms, Artificial Intelligence, and Joint Conduct," available at: https://www.sheppardmullin.com/media/article/1649_CPI%20-%20Ballard-Naik.pdf, 6

²⁵⁴ Ibid

²⁵⁵ Ariel Ezrachi, "How pricing bots could form cartels and make things more expensive," *Harvard Business Review*, (2016), <https://hbr.org/2016/10/how-pricing-bots-could-form-cartels-and-make-things-more-expensive>

of intent, meeting of the minds and communication “presuppose quintessentially human mental states” and can prove less useful in dealing with computers²⁵⁶.

According to another concept, which is the one I firmly believe is the most reasonable, an algorithm even can do “a better job than humans at establishing a cooperative relationship”²⁵⁷. Even though there are concerns regarding its likelihood all the time, even tacit type of collusion now seems “not only possible but rather, it is inevitable”²⁵⁸.

It is also important to consider that firms that use pricing algorithms for their businesses can assume the anticompetitive effects and reaching of supra-competitive prices, since these learning algorithms are self-taught, their programmers “give them wings, and they fly to their destinations, their pre-assigned goals, on their own”²⁵⁹. Maybe we can think philosophically about collusion: A Plato or Descartes may say “It is nature that makes these tendencies so inevitable”²⁶⁰. There are quite negative risks that they entail regarding the supra-competitive prices, consumer harm and restriction of competition in markets creating entry barriers as well. Although some researchers credit the success of algorithms to loyalty and honesty that humans lack and it is possible to design them in a way that exhibits trust, does this mean that we should stop focusing on them and their negative outcomes? Before the moment humans lack control over such technologies completely, it is better to assess risks and address remedies.

The increased sophistication of technologies and their potential for unlawful conduct raise concerns of global antitrust and competition enforcers and according to Commissioner Margrethe Vestager such algorithms have to be built in a way that prevents them from colluding and basically, companies cannot escape responsibility “by hiding behind a computer program”²⁶¹.

While discussing both concepts it would be insightful to refer to the half-a-century debate between Posner and Turner. Richard Posner advocated widening the scope of the concepts of agreement or concerted practice to include conscious parallelism since he believes tacit collusion is not

²⁵⁶ Salil K. Mehra, "Antitrust and the Robo-Seller: Competition in the Time of Algorithms," 100 Minn. L. Rev. 1323, (2016), 1352

²⁵⁷ Ai Deng, "When Machines Learn to Collude: Lessons from a Recent Research Study on Artificial Intelligence," Available at SSRN: <https://ssrn.com/abstract=3029662>, (2017), 4

²⁵⁸ Terrell McSweeney and Brian O'Dea, "The Implications of Algorithmic Pricing for Coordinated Effects Analysis and Price Discrimination Markets in Antitrust Enforcement," Antitrust, vol. 32, no. 1(2017), 76

²⁵⁹ Laura Hamdan, "Algorithmic Collusion: From Smokeroom to Code Lines? How Collusion Can Evolve & Are We Prepared," Canadian Competition Law Review (CCLR), vol. 35, no. 2 (2022), 71-72

²⁶⁰ Ibid

²⁶¹ Dylan I. Ballard and Amar S. Naik, "Algorithms, Artificial Intelligence, and Joint Conduct," available at: https://www.sheppardmullin.com/media/article/1649_CPI%20-%20Ballard-Naik.pdf, (2019), 2

unconscious²⁶². He affirms firms that priced interdependently, “even where they did not communicate or signal their intent to each other apart from observing each other’s price decisions” must be caught under competition rules²⁶³.

Turner, on the other hand, suggests that conscious parallelism, meaning tacit collusion, is different from an agreement since it “obeys the individual response of competitors to the economic circumstances” and therefore, this should not be a violation of competition rules if there is no evidence that parallel actions were made contrary to the “apparent individual self-interest” and when competitors simply respond to the same circumstances, regardless of the actions of other competitors²⁶⁴.

The only clarity on this issue is that current competition law needs to be revamped to assimilate technical challenges of the 21st century²⁶⁵. Although there are clear risks that algorithms pose to competition, this area is still of high complexity and uncertainty, “where lack of intervention and over-regulation could both pose serious costs on society, especially given the potential benefits from algorithms” and in this regard, all actions taken in the future must be deeply assessed²⁶⁶.

²⁶² Sumit Singh Bhadauria and Lokesh Vyas, "Algorithmic Pricing & Collusion; The Limits of Antitrust Enforcement," *Nirma University Law Journal*, vol. 8, no. 2, (2019), 103-104

²⁶³ Salil K. Mehra, "Antitrust and the Robo-Seller: Competition in the Time of Algorithms," 2016, *Minnesota Law Review*, 1341

²⁶⁴ Jaime Eduardo Castro Maya, "The Limitations on the Punishability of Tacit Collusion in EU Competition Law," *Centro de Estudios de Derecho de la Competencia* (2018), 213-215

²⁶⁵ Sumit Singh Bhadauria and Lokesh Vyas, "Algorithmic Pricing & Collusion; The Limits of Antitrust Enforcement," *Nirma University Law Journal*, vol. 8, no. 2, July (2019), 105-106

²⁶⁶ Background Note by the Secretariat on "Algorithms and Collusion," 21-23 June 2017, 50

6. Possible counter-measures and their implications

6.1. Importance of Remedies and Literature

The real fact we can only be sure about pricing algorithms is the challenges and problems they may pose in the competition policy. Algorithmic pricing opens new forms of antitrust intervention and regarding tacit collusion, today, the prevalent approach is relatively lenient, in part because among human decision-makers it is regarded as extremely difficult to achieve. While we have no direct comparative evidence for algorithms relative to humans, our results still suggest that algorithmic collusion might not be “that improbable”²⁶⁷. In this regard, it is also important to note we should not lower the importance of law. As one court noted, “the advancement of technological means for the orchestration of large-scale price-fixing conspiracies need not leave antitrust law behind”²⁶⁸.

Since the integration of algorithmic collusion into Article 101 TFEU is not an easy process, we need more literature and evidence regarding this and assessing different measures that can credit its illegality. In the literature, there are suggestions on what remedies can be used to prevent this threat or to collect more data to implement the extension of the scope of Article 101. Actually, the main reason for the legality of algorithmic collusion under current competition enforcement rules is the lack of a remedy²⁶⁹. So in this chapter, we will discuss which remedies can be sufficient and which cannot.

While assessing what can be done it is crucial to evaluate the pro- and anticompetitive effects of them and adopt “a prudent view” so we do not exert chilling effects that are not necessary for technological innovation²⁷⁰. Courts, enforcers, and scholars should focus on identifying conduct that threatens innovation²⁷¹. But what if the innovation itself reduces consumer welfare? E-cigarettes, for example, can describe this red line the best. It is not healthy for consumers, but it is an innovation under antitrust case law and non-legal definitions²⁷². There is a similar case for algorithms.

²⁶⁷ Emilio Calvano, Giacomo Calzolari, Vincenzo Denicolo, and Sergio Pastorello, "Artificial Intelligence, Algorithmic Pricing and Collusion," SSRN, (2019), 35

²⁶⁸ Michal Gal S., "Algorithms as Illegal Agreements," Berkeley Technology Law Journal, vol. 34, no. 1, (2019), 117-118)

²⁶⁹ Kenji Lee, "Algorithmic Collusion & Its Implications for Competition Law and Policy," (2018), Available at SSRN: <https://ssrn.com/abstract=3213296>, 35

²⁷⁰ Ai Deng, "What Do We Know about Algorithmic Tacit Collusion," Antitrust, vol. 33, no. 1 (2018), 93-94

²⁷¹ Alexander Mackay & Samuel N. Weinstein, "Dynamic Pricing Algorithms, Consumer Harm, and Regulatory Response," Washington University Law Review, (2022), 168-172

²⁷² Ibid

Some argue authorities already have investigative powers to reveal all information for violation detection and they can use such powers in instances where algorithms implement and monitor express cartel agreements²⁷³. But if this was the case, where does all the concern derive from?

In this regard, the prohibition of algorithmic pricing is also suggested which for me is the most unwanted one and does not seem appropriate now considering the big efficiency gains of algorithms²⁷⁴.

Some evaluate algorithmic collusion as a plus factor. If there is no direct evidence of an agreement, “the common use of similar pricing algorithms in competitive markets could serve as a “plus factor”²⁷⁵. For example, it is unlikely for competing firms to rely on the same characteristics in their prices and even if we speak about the same product market, competitors would still target different groups, sell different forms of products, provide different services and so on²⁷⁶. So this can be indicative of the collusive intention. So companies should be cautious not to agree with competitors to adopt a similar pricing algorithm”²⁷⁷. It is also affirmed the dangers of parallel conduct with pricing algorithms are “more extreme than traditional forms of interdependence” as algorithms can lead to long-lasting and more stable price controls²⁷⁸. That’s why they are mainly assessed under the shadow of plus factors.

Plus factors are also known as facilitating practices. This practice can also be interpreted as “positive, avoidable actions, engaged in by market players, which allow firms to easier and more effectively achieve coordination, by overcoming the impediments to coordination”, so they increase the incentives to cooperate and reduce their incentives to compete despite their divergent interests, but these practices are avoidable actions²⁷⁹.

We see companies would not engage in such conduct if they did not expect others to react to them, so a facilitating practice is a “part of an indirect communication device used between firms to signal to each other their intent to engage in coordinated conduct”²⁸⁰. But since all coordination

²⁷³ Note by BIAC on "Algorithmic Competition," 140th OECD Competition Committee meeting on 14-16 June (2023), 7-8

²⁷⁴ Emilio Calvano, Giacomo Calzolari, Vincenzo Denicolò, and Sergio Pastorello, "Algorithmic Pricing: What Implications for Competition Policy?," Available at SSRN: <https://ssrn.com/abstract=3209781>, (2018), 14

²⁷⁵ Dylan I. Ballard and Amar S. Naik, "Algorithms, Artificial Intelligence, and Joint Conduct," available at https://www.sheppardmullin.com/media/article/1649_CPI%20-%20Ballard-Naik.pdf, 4-5

²⁷⁶ Ibid

²⁷⁷ Ai Deng, "What Do We Know about Algorithmic Tacit Collusion," *Antitrust*, vol. 33, no. 1, Fall (2018), 93-94

²⁷⁸ Dylan I. Ballard and Amar S. Naik, "Algorithms, Artificial Intelligence, and Joint Conduct," available at https://www.sheppardmullin.com/media/article/1649_CPI%20-%20Ballard-Naik.pdf, 4-5

²⁷⁹ Michal Gal, "Algorithmic-facilitated Coordination," 127th meeting of OECD Competition Committee (2017), 18-19

²⁸⁰ Ibid

can be executed with them and collusive actions can be created, can we leave this just by stating a plus factor for the coordination and not illegal itself? I believe not, that's why this collusion might be integrated into Article 101 by introducing effective remedies by competition authorities. It is worth attention it can be reached only via a pricing algorithm.

It is true to say that if remedies are sufficiently strong, then market players will have “strong motivations not to engage in the prohibited conduct”²⁸¹. If pricing algorithms turn market structures into beneficial for them, then ex-ante suggestions can become less useful since they can be reverted to some extent, such as by entry barriers by algorithms, so that ex-post interventions might be more effective²⁸².

So considering all these, it is important to discuss suggested ex-ante and ex-post measures to effectively capture algorithmic collusion.

6.2. Ex-ante and ex-post measures

Currently, there is no consensus about the most suitable investigative tools²⁸³. It is also difficult to say directly which remedy can be the most efficient.

So it is important to discuss ex-ante measures such as the adoption of new Regulation, merger control enforcement, incubators, and more and ex-post measures including but not limited to market investigations in detail.

6.2.1. Adoption of new Regulation

One of the suggested measures is the adoption of a new Regulation for algorithms and their terms of use. It is discussed to include restrictions on the operation of algorithms and price regulation for the market subjects²⁸⁴. This has a checkered reputation among policymakers and economists, but it is a viable option “when market conditions warrant, and we argue that the consumer harm algorithmic pricing will cause can be addressed by regulatory intervention”²⁸⁵.

²⁸¹ Ibid, P. 22

²⁸² Ilgin Isgenc, "Competition Law in the AI ERA: Algorithmic Collusion under EU Competition," Trinity College Law Review, 24 (2021), 35-54

²⁸³ Note by BIAC on "Algorithmic Competition," 140th OECD Competition Committee meeting (2023), 8-10

²⁸⁴ Alexander Mackay & Samuel N. Weinstein, "Dynamic Pricing Algorithms, Consumer Harm, and Regulatory Response." Washington University Law Review, (2022), 120

²⁸⁵ Ibid

Limiting the main features of algorithms, without the requirement of detailed knowledge of the calculations about their performance, can be a good option may be²⁸⁶ such as a restriction on the frequency of price changes. For example, prohibiting pricing frequency by requiring firms to price at the same time and on the same schedule, for example, say at 6 a.m. every day can eliminate the possibility of follower conduct which leads sellers in the market to charge supra-competitive prices²⁸⁷.

This can also be an administrable reform since the regulator would not need to evaluate individual firms' algorithms and its task would be to ensure the pricing occurs at authorized times²⁸⁸. This has been implemented in the fuel sector in Austria and Western Australia, where sellers were limited to match prices more than once a day. In doing so, the mechanism seeks to allow to undercut the price and promote the reputation of a discounter. Algorithms, while monitoring the rivals' pricing maneuvers, would face a delay in changing prices now. So, the maverick could profit from being the first one to discount and not surprisingly, state intervention through such disruptions can lead to sub-optimal results such as restrictions on the speed of changes may result in preventing sellers from discounting²⁸⁹.

What can be the negative side of this measure? A potential downside is it prevents companies from reacting quickly to changes in markets which can cause collusion²⁹⁰. If undertakings are restricted from pricing more than once per day, the incentive to produce faster algorithms can be reduced²⁹¹. Restricting frequency can also bar algorithms from considering rivals' prices which can soften incentives to develop sophisticated price competition strategies and this is not the aim of the competition policy since we aim "to enhance innovation, not dull it"²⁹².

Another objection is such limitation restricts the ability of firms to be nimble because when firms adjust prices as often as they want, this can let them efficiently respond to supply and demand changes meaning yield lower costs and lower prices for consumers²⁹³.

Reporting the use of certain algorithms can also be effective under the new Regulation, but this can impose costs at authority and company levels and authorities would have difficulty overseeing

²⁸⁶ Ibid, 122

²⁸⁷ Ibid

²⁸⁸ Ibid

²⁸⁹ Note by Ariel Ezrachi & M. E. Stucke on Algorithmic Collusion: Problems and Counter-Measures, Directorate for Financial and Enterprise Affairs Competition Committee, (2017), 28

²⁹⁰ Alexander Mackay & Samuel N. Weinstein, "Dynamic Pricing Algorithms, Consumer Harm, and Regulatory Response," Washington University Law Review, (2022), 122

²⁹¹ Ibid, 123

²⁹² Ibid, 168

²⁹³ Ibid, 163

firms' attempts to design an algorithm to optimize performance “while instructing it to ignore or respond irrationally to market information and competitors' moves”²⁹⁴.

The other suggestion is a rule that prohibits incorporating rivals' prices into algorithms, but this seems quite challenging to administer²⁹⁵. Another suggestion includes requiring companies to disclose the data used in algorithms publicly or programming them to ignore commercially sensitive information²⁹⁶. Maximum price regulations are another option, but such price regulations not only reduce motivation to innovate or to provide quality products but actually result in higher prices creating a focal point for the collusion in digital markets²⁹⁷.

So as seen from the discussion, all suggestions seem quite problematic. We should be very careful about every article of newly proposed regulations and all details need to be assessed well to avoid dramatic outcomes. I believe the less intrusive reform—restricting the time when firms can change prices—could be an approach considering the level of our current knowledge regarding algorithmic pricing. But it is important to remember that technology develops so fast in unpredictable ways, and authorities should remain swift for changes²⁹⁸.

Other than the Regulation, the creation of a centralized algorithm regulator is also suggested. But it is not difficult to foresee the massive task of evaluating all algorithms across all sectors such an authority would face²⁹⁹.

6.2.2. Pricing Incubators

Pricing incubators are one of the most discussed measures in the fight against algorithmic collusion suggested by Ezrachi and Stucke.

The authors propose devising an algorithmic pricing incubator that the authorities can use “to make simulations and discern whether firms are pricing competitively or are capturing economic profits by reducing consumer welfare”³⁰⁰. They suggest reducing the frequency of price changes, price transparency for the algorithms but not for consumers and the ability to collude can

²⁹⁴ Ariel Ezrachi and Maurice E. Stucke, "Artificial Intelligence & Collusion: When Computers Inhibit Competition," *University of Illinois Law Review*, vol. 2017, no. 5, (2017), 1806.

²⁹⁵ Alexander Mackay & Samuel N. Weinstein, "Dynamic Pricing Algorithms, Consumer Harm, and Regulatory Response," *Washington University Law Review*, (2022), 122

²⁹⁶ Ariel Ezrachi and Maurice E. Stucke, "Artificial Intelligence & Collusion: When Computers Inhibit Competition," *University of Illinois Law Review*, vol. 2017, no. 5, (2017), pp. 1799-1800.

²⁹⁷ Background Note by the Secretariat on "Algorithms and Collusion," 21-23 June 2017, 48

²⁹⁸ Alexander Mackay & Samuel N. Weinstein, "Dynamic Pricing Algorithms, Consumer Harm, and Regulatory Response," *Washington University Law Review*, (2022), 174

²⁹⁹ *Ibid*, 166

³⁰⁰ Beneke, F., Mackenrodt, MO. "Artificial Intelligence and Collusion," *IIC* 50, (2019), 129

be tested in the algorithmic pricing incubator³⁰¹. In simple terms, an incubator is a computer simulation that considers the market, demand, and supply characteristics and helps competition officials test under which conditions collusion can occur, and the effects of different counter-measures for destabilizing this collusion³⁰².

For the implementation of this measure, one way is when an authority examined the available pricing algorithms and used the data and ran simulations in an incubator, that authority algorithms could “shadow the industry’s algorithms” and test what conditions were added to the incubator could make algorithmic collusion likelier³⁰³.

These incubators can help to understand what factors need to be explored better to destabilize algorithmic collusion³⁰⁴. But such incubators look imperfect since they are static and would not reflect market dynamics and algorithm changes over the long term³⁰⁵. It is necessary to remember new inventions will continue to appear and revolutionize our understanding of algorithms and lessons we learn today can be outdated soon meaning the antitrust community needs to keep a close eye on this matter so we can be well-prepared and proactive to solve problems ahead³⁰⁶. Considering this, they can be used in the first phase of understanding black box algorithms, but not in later stages.

6.2.3. Consumer algorithms (“digital butlers”)

One of the suggestions includes consumer algorithms, namely, digital butlers. This is a solution by Michal Gal to increase consumer interaction in markets.

He has proposed consumers can create their own algorithms to counter sellers’ algorithms and this way they can fight back to coordinated pricing with such algorithms avoiding unwanted sellers and creating buyer power³⁰⁷. Such buyer power might be created when a butler has a large number of users, or if it coordinates with other consumers³⁰⁸. In simple terms, algorithmic consumers are

³⁰¹ Francisco Beneke and Mark-Oliver Mackenrodt, "Remedies for Algorithmic Tacit Collusion," *Journal of Antitrust Enforcement* (2021), 173

³⁰² Ariel Ezrachi and Maurice E. Stucke, "Sustainable and Unchallenged Algorithmic Tacit Collusion," *Northwestern Journal of Technology and Intellectual Property*, vol. 17, no. 2, (2020), 256-59.

³⁰³ Note by Ariel Ezrachi & M. E. Stucke on "Algorithmic Collusion: Problems and Counter-Measures," (2017), Directorate for Financial And Enterprise Affairs Competition Committee, 28

³⁰⁴ *Ibid*

³⁰⁵ *Ibid*

³⁰⁶ Ai Deng, "When Machines Learn to Collude: Lessons from a Recent Research Study on Artificial Intelligence," Available at SSRN: <https://ssrn.com/abstract=3029662>, (2017), 7-8

³⁰⁷ Alexander Mackay & Samuel N. Weinstein, "Dynamic Pricing Algorithms, Consumer Harm, and Regulatory Response," *Washington University Law Review* (2022) 132

³⁰⁸ Michal Gal, "Algorithmic-facilitated Coordination," 127th meeting of OECD Competition Committee on 21-23 June 2017, 10-13

employed by consumers to “make and execute decisions for the consumer by directly communicating with other systems through the Internet” and they identify a need automatically, search for an optimal price and on behalf of the consumer execute the transaction³⁰⁹. These algorithms have so many benefits for consumers and this is not a new concept in the markets.

Consumers can develop parameters for destabilizing oligopolistic structures and even sometimes detect cartels³¹⁰. These algorithms can also identify the preferences of consumers using data provided by the consumer or collected from previous choices and based on these, the butler can find an appropriate purchase and execute the transaction³¹¹. Butlers have a benevolent nature and considering this, they can reduce search, transaction and information costs, make decisions more quickly, and are not subject to traditional consumer biases³¹² and enable more rational and sophisticated choices³¹³.

Such algorithms can be coded not to buy certain goods when the price is above a specific level and may be coded to include certain decisional parameters that are designed to eliminate or reduce market failures in the long run³¹⁴.

Considering the above, we can firmly say that consumer algorithms can beat supplier algorithms sometimes³¹⁵ and can change market conditions by introducing a new active player into the market game³¹⁶.

Finally, the other benefit of butlers is the decrease in price discrimination. By aggregating the consumers’ choices into one virtual buyer, they “obscure the personal demand curves of the consumers” which serves to increase consumers’ welfare when suppliers are required to set a lower price³¹⁷. So as Gal explains, algorithmic consumers could improve market dynamics and limit the negative effects of algorithmic-facilitated coordination without the need for legal intervention³¹⁸.

³⁰⁹ Ibid

³¹⁰ Francisco Beneke and Mark-Oliver Mackenrodt, "Remedies for Algorithmic Tacit Collusion," *Journal of Antitrust Enforcement* (2021), 174

³¹¹ Peter Georg Picht and Benedikt Freund, "Competition (Law) in the Era of Algorithms," *Max Planck Institute for Innovation & Competition Research Paper No. 18-10*, SSRN (2018), 99

³¹² Ibid

³¹³ Michal Gal, "Algorithmic-facilitated Coordination," 127th meeting of OECD Competition Committee on 21-23 June 2017, 10-13

³¹⁴ Michal Gal, "Algorithmic-facilitated Coordination," 127th meeting of OECD Competition Committee on 21-23 June 2017, 10-13

³¹⁵ Ibid

³¹⁶ Ibid

³¹⁷ Ibid

³¹⁸ Ibid

I believe, however, consumer algorithms cannot solve all problems regarding algorithmic collusion and this could be a partial solution to a certain part of concerns. While discussing the positive effects, the risks and limitations arising from digital butlers cannot be ignored. There can be significant antitrust risks if buyers use these algorithms for anti-competitive agreements³¹⁹. In such a case, the following limitations can be present: (i) digital butlers can enter into illegal agreements or abuse their power, (ii) suppliers of consumer algorithms can be dominated by firms that may not have consumers' best interest, and (iii) the supply can take countermeasures to such consumers³²⁰.

In other words, consumer algorithms can likely infringe on competition laws if they are found to engage in anti-competitive agreements. They can even create entry barriers while reaching potential consumers in the market and if the market is dominated by them that are not benign this can serve their suppliers' purposes³²¹.

6.2.4. Merger control

Although I will not touch upon the merger rules in-depth, it would be beneficial to point out one of the main discussions regarding collusion. Considering pricing algorithms are present and the risks arising from algorithmic collusion are emerging, it is necessary to investigate the risks of coordinated effects³²².

This solution suggestion embodies establishing a system that is capable of preventing algorithmic collusion, through merger control rules in markets with algorithmic activities and this includes authorities lowering the threshold of intervention and investigating the risk of coordinated effects not only in cases of 3 to 2 mergers but also in 4 to 3 or even in 5 to 4³²³.

But the question arises of how effective this will be. The debate on lowering thresholds has been on trend for many years. This started from the phenomenon of killer acquisitions. Although this concern has been on trend for years, an expression of intent of the EU competition authorities has not been observed. So maybe we have to leave this discussion and might need a new at-hand solution interpreting that it is not in the plan of competition authorities.

³¹⁹ Alexander Mackay & Samuel N. Weinstein, "Dynamic Pricing Algorithms, Consumer Harm, and Regulatory Response," *Washington University Law Review*, (2022), 132

³²⁰ Francisco Beneke and Mark-Oliver Mackenrodt, "Remedies for Algorithmic Tacit Collusion," *Journal of Antitrust Enforcement*, (2021), 174

³²¹ Michal Gal, "Algorithmic-facilitated Coordination," 127th meeting of OECD Competition Committee on 21-23 June 2017, 10-13

³²² Ariel Ezrachi and Maurice E. Stucke, "Sustainable and Unchallenged Algorithmic Tacit Collusion," *Northwestern Journal of Technology and Intellectual Property*, vol. 17, no. 2, (2020), 258.

³²³ Background Note by the Secretariat on "Algorithms and Collusion," 21-23 June 2017, 40

6.2.5. Market investigations

A market investigation, also known as a market inquiry by competition authorities can provide an “effective ex-post vehicle”³²⁴ for markets. Regarding algorithmic collusion, authorities can examine whether algorithms end in coordinated effects and identify the circumstances and fields under which this collusion is more likely³²⁵. To realize this first, it is necessary to clarify sectors in which investigation is important.

Market inquiries can be useful in helping agencies understand the dynamics in algorithm-driven markets and the magnitude of competitive problems³²⁶. I believe with market inquiries, the authorities can gain precious knowledge regarding actions taken by algorithms. They can be extra useful to understand failures in the market and find when there are signs regarding the bad functioning of markets, but no indications of coordination among players³²⁷. The UK Competition and Markets Authority can be an example that has the power to initiate market investigations, gather evidence, and, when necessary, impose necessary remedies³²⁸. This authority can even go beyond market studies and engage in investigations³²⁹.

In the EU law, the right for sector inquiries is already stipulated in Regulation 1/2003. Article 17 of the said Regulation gives the Commission power to conduct investigations into sectors of the economy and into types of agreements. According to that Article, where the competition may be restricted or distorted, the Commission can conduct its inquiry into a particular sector of the economy or into a particular type of agreement and the Commission may request to supply the necessary information from undertakings or associations of undertakings concerned and may carry out any inspections for that purpose. It may require all necessary information by simple request or by decision specifying what information is required and fixing the time limit³³⁰.

According to Articles 23 and 24 of the Regulation, the Commission can even impose fines for the provided incorrect information and these serve “to guarantee the effective execution of a sector

³²⁴ Ariel Ezrachi and Maurice E. Stucke, "Artificial Intelligence & Collusion: When Computers Inhibit Competition," *University of Illinois Law Review*, vol. 2017, no. 5, (2017), 1806.

³²⁵ Background Note by the Secretariat on "Algorithms and Collusion," 21-23 June 2017, 39-40

³²⁶ Note by Ariel Ezrachi & M. E. Stucke, "Algorithmic Collusion: Problems and Counter-Measures," (2017), Directorate for Financial and Enterprise Affairs Competition Committee, 22

³²⁷ Background Note by the Secretariat on "Algorithms and Collusion," 21-23 June 2017, 39-40

³²⁸ Ariel Ezrachi and Maurice E. Stucke, "Artificial Intelligence & Collusion: When Computers Inhibit Competition," *University of Illinois Law Review*, vol. 2017, no. 5, (2017), 1806.

³²⁹ Background Note by the Secretariat on "Algorithms and Collusion," 21-23 June 2017, 39-40

³³⁰ Article 18 of Regulation 1/2003

inquiry”³³¹. As clear from the recent Commission decision regarding Amazon’s Buy Box³³², authorities can obtain access to algorithms and examine their functioning³³³. This suggests the existing powers for investigation are sufficient to gain the evidence required for a finding of violations³³⁴. However, the Commission has not been conferred powers to remedy identified defects as a result of inquiries on a general basis³³⁵. The lack of such power is open to critics. As a consequence, I think no new investigative powers are needed, but powers to remedy detected defects and the current powers only need to be enforced more effectively.

Especially for oligopolistic markets, market investigations seem to be a useful instrument. Such an investigation can clarify what algorithms and to what degree are used in a market and which competitive effects they have and this information can be used “to devise a theory of harm for an individual enforcement action”³³⁶.

After such inquiries, the Commission can publish a report on the results in particular sectors of the economy or particular types of agreements across various sectors³³⁷. Such reports can also make the developers and other interested parties that the liability can be imputed to design the algorithms in a proper way that decreases the algorithmic collusion risks. Dealing with this, it is also important for competition authorities to have professional dedicated teams for algorithmic collusion and other issues raised by Big Data and AI related to competition and the tools in detecting collusion should be developed if necessary³³⁸.

Overall, with sector investigations authorities can succeed in structuring the market to produce desirable outcomes by creating decentralized learning and proper intervention during the process³³⁹. That’s why I believe it is sufficient and helpful to conduct these investigations in necessary markets before illegalizing algorithmic collusion, specifically tacit form. This can help to evaluate in which industries we can expect algorithmic collusion and how. After we have some initial evidence that algorithms are “significantly contributing to price increases through tacitly

³³¹ Francisco Beneke and Mark-Oliver Mackenrodt, "Remedies for algorithmic tacit collusion," *Journal of Antitrust Enforcement*, (2021), 172-74

³³² COMMISSION DECISION of 20.12.2022 relating to a proceeding under Article 102 of TFEU and Article 54 of the EEA Agreement Cases AT.40462 – Amazon Marketplace and AT.40703 – Amazon Buy Box

³³³ Note by BIAC on Algorithmic competition, 140th OECD Competition Committee meeting on 14-16 June 2023, 8-10

³³⁴ Ibid

³³⁵ Francisco Beneke and Mark-Oliver Mackenrodt, Remedies for algorithmic tacit collusion, *Journal of Antitrust Enforcement*, (2021), 172-174

³³⁶ Ibid

³³⁷ Article 17 of Regulation 1/2003

³³⁸ Ariel Ezrachi and Maurice E. Stucke. "Sustainable and Unchallenged Algorithmic Tacit Collusion." *Northwestern Journal of Technology and Intellectual Property*, vol. 17, no. 2, (2020), 256-259.

³³⁹ Ibrahim Abada & Xavier Lambin, Artificial intelligence: Can seemingly collusive outcomes be avoided? Available at SSRN: <https://ssrn.com/abstract=3559308>, (2022), 1

collusive interdependence”, then it might be necessary to cover algorithmic collusion and revise the concept under Article 101 and the current legal treatment of this type of collusion³⁴⁰.

6.2.6. Auditing algorithms

Auditing mechanisms of algorithms are suggested as one of the methods to assess algorithmic collusion cases. It is argued this can guarantee algorithms are programmed “in a way to steer clear of any competition concerns”³⁴¹. But, while discussing the learning and auditing algorithms it is important to highlight first, they do not include instructions to collude necessarily but aim to maximise profit, secondly, auditing will not keep pace with the development in the industry and finally, it is difficult to prevent algorithms from ignoring public³⁴².

One of the important aspects is also some codes and data are highly confidential and can comprise competitively sensitive information of a company related to company’s success and valuable know-how³⁴³. That’s why, this needs to be assessed very carefully. Only if a close review of an algorithm is indispensable and it is quite necessary for the investigation, the authorities could gain access to the algorithm keeping in mind such a review can be complex, difficult, and may not provide efficient proof of harm due to the limited techniques on the existing algorithms³⁴⁴.

This is also debatable how the competition authority can list the algorithms for which an audit mechanism is necessary. This can end up with thousands of algorithms which would be impossible to audit effectively. I believe even though we avoid auditing the mechanisms and characteristics of algorithms of numerous businesses, it is still a must to understand their functioning better and more deeply.

³⁴⁰ Background Note by the Secretariat on Algorithms and Collusion, 21-23 June 2017, 50

³⁴¹ Ibid, 41

³⁴² Ibid

³⁴³ Note by BIAC on Algorithmic competition, 140th OECD Competition Committee meeting on 14-16 June (2023), 8-10

³⁴⁴ Ibid

7. Conclusion

Rapid developments in technology and the enhancing effects of computers have a significant impact on how we interact, communicate and trade. These developments have brought chances to meet and coordinate online. The question “Why meet in person, when the meeting can take place in the virtual world?” raises³⁴⁵. Since brick-and-mortar shops are becoming out of trend and we integrate into the online world, this makes the effects of algorithms more considerable every day.

As Vestager said we should pay attention to how algorithms are developing³⁴⁶. Pricing algorithms have become the main assistant of businesses for setting price strategies and updating following market changes. The complex and time-consuming actions for businesses have become much easier and quicker. Previously, the operations of specific actions that took days have been replaced with seconds by algorithms. So these algorithms suggest great advantages to sellers meaning their use can only grow in the future, maybe even extend to brick-and-mortar stores³⁴⁷.

The influence on the competitive markets is also inevitable. Companies can conclude their illegal agreements through coding algorithms and even sometimes without coding these mechanisms can reach anti-competitive collusive outcomes. In other words, alongside their benefits for markets, algorithms are deemed useful tools to facilitate both explicit and tacit collusion.

To address my main research question in this thesis, I discussed the main components of Article 101 TFEU thoroughly, analyzed the role and effects of price-fixing algorithms, emphasized the potential risks that may arise from them after a detailed understanding of the notion of collusion and evaluated different remedies to minimize the potential negative outcomes. I highlighted that even if algorithms are not coded in a way to directly collude, they can end up reaching such an outcome tacitly. This means, for instance, even if algorithms are only instructed to maximize profits and they execute the most optimal strategy they detect, based on learning and collected data from the specific market³⁴⁸, this still might result in an algorithmic collusion case. This way, they can raise prices above a certain competitive level in a coordinated fashion, even if they are not instructed specifically and do not communicate³⁴⁹. So the use of algorithms in pricing can make

³⁴⁵ Ana Poscic and Adrijana Martinovic. "EU Competition Law in the Digital Era: Algorithmic Collusion as a Regulatory Challenge." *EU and Comparative Law Issues and Challenges Series*, 4, (2020), 1019.

³⁴⁶ Nicolas Petit. "Antitrust and Artificial Intelligence - A Research Agenda." *Journal of European Competition Law & Practice*, 1-2, (2017). Available at SSRN: <https://ssrn.com/abstract=2993855>, 4

³⁴⁷ Alexander Mackay & Samuel N. Weinstein, *Dynamic Pricing Algorithms, Consumer Harm, and Regulatory Response*, *Washington University Law Review*, (2022), 173

³⁴⁸ Ariel Ezrachi and Maurice E. Stucke. "Artificial Intelligence & Collusion: When Computers Inhibit Competition." *University of Illinois Law Review*, vol. 2017, no. 5, (2017), 1783-84.

³⁴⁹ Emilio Calvano, Giacomo Calzolari, Vincenzo Denicolo, and Sergio Pastorello. "Artificial Intelligence, Algorithmic Pricing, and Collusion." *SSRN*, (2019), 2

algorithmic collusion “more achievable and easier to sustain, but at the same time an algorithm implemented with innocent intent could result in entirely unintentional collusion, making prosecution difficult”³⁵⁰.

Some still insist algorithmic tacit collusion is quite unlikely and to date, there has been no case where algorithms colluded tacitly and only in a few cases, they were used only as facilitators. But we analysed that it is not really improbable and even while aiming profit maximisation they can reach tacit collusion in the market and sustain higher prices that harm consumers in the end. For this to be assertive, it is necessary to look at experimental studies and the unpredictable development of black box algorithms. There are algorithms that humans may lack control and understanding of their actions. This raises bright red flags.

Even though this concept is not illegal under Article 101 TFEU, this is quite problematic while analyzing and realizing the potential risks that this might cause. In this regard, I believe we need to be careful and initiate actions to sustain control in competitive markets.

I did all the above research to find a firm answer on how effective the current EU competition laws are in fighting against the modern challenges posed by pricing algorithms and what necessarily might to be done at the legislative level, mainly under Article 101 TFEU to prevent such collusion. It is not easy to give a straightforward answer at this point that yes the definition of “concerted practice” must be extended to cover algorithmic collusion as long as we have many uncertainties regarding the concepts of “intention” and “communication”, understanding the logic behind the moves of algorithms and empiric studies about the factual outcomes.

Although there is a lack of empirical evidence, I believe we can rely on the experimental studies conducted, and theories on how they can end up in autonomous collusion. Relying on that we do not have any evidence yet does not mean that we can ignore potential risks and this can prevent us from shedding light on this area. In other words, this does not mean we can preserve the status quo and it is time to bring algorithmic price coordination out of the “black-letter law's blind spot” before it alters market structures irreversibly³⁵¹.

In this regard, it is time to think and take some steps before we lose all control. We even have more responsibility now by analyzing and understanding the mechanisms of algorithms and assessing the best remedies for competition law, consumer welfare and innovation in the end to prevent potential future problems that these mechanisms may create.

³⁵⁰ Catalina González Verdugo. "Horizontal Restraint Regulations in the EU and the US in the Era of Algorithmic Tacit Collusion." *University College London Journal of Law and Jurisprudence*, (2018), 116

³⁵¹ Ana Poscic and Adrijana Martinovic. "EU Competition Law in the Digital Era: Algorithmic Collusion as a Regulatory Challenge." *EU and Comparative Law Issues and Challenges Series*, 4, (2020), 1037.

As algorithms are one of the “most closely held secrets in Silicon Valley and elsewhere”³⁵², I think we need more research to decide on the exact answer to the integration of algorithmic collusion under Article 101 TFEU and gather all useful information that credits this realizing there is no point in losing time. There are quite many suggestions when it comes to tackling this challenge. They all have pros and cons for competition. The potential negative effects of algorithmic collusion are also becoming more and more real in line with the development of self-learning algorithms.

Considering all these, I believe a more targeted study can shed more light on the competitive aspects of AI and their likelihood of colluding³⁵³. It would be effective to investigate sectors and start with market investigations to detect which sectors are prone to collusion and how to sustain effective competition with necessary interventions. This can help to evaluate in which industries we can expect algorithmic collusion and how. To implement such investigations effectively, we need reasonable remedies for the enforcement of the Commission’s power.

Alongside sector inquiries analysing algorithms to understand their operation to the possible extent before they become more and more complex and complicated is also a must. This way monitoring possible collusion risks of pricing algorithms in the digital markets would be real.

After we have more apparent evidence that algorithms are “significantly contributing to price increases through tacitly collusive interdependence”, then it would be necessary to cover algorithmic tacit collusion and revise the concept under Article 101 and the current legal treatment of this type of collusion³⁵⁴ to protect trade between Member States and prevent the restriction or distortion of competition within the internal market. In other words, when have a better understanding of the risks of algorithmic collusion, and the evidence that pricing algorithms enhance collusive results, then updating current antitrust laws can be considered³⁵⁵. We can do so by extending the understanding of the definition of concurrence of wills and communication. At such a point, it would be important to adapt the legal framework to the developing technology without preventing its effectiveness.

By doing so, undertakings could be held liable for the actions of their algorithms just as their employees which would make them be careful about the use of pricing algorithms. While regulating this, it is very important not to cast a shadow on the innovation and efficiency gains and

³⁵² Ibrahim Abada and Xavier Lambin. "Artificial Intelligence: Can Seemingly Collusive Outcomes Be Avoided?" Available at SSRN: <https://ssrn.com/abstract=3559308>, (2022), 38

³⁵³ Ai Deng. "When Machines Learn to Collude: Lessons from a Recent Research Study on Artificial Intelligence." Available at SSRN: <https://ssrn.com/abstract=3029662>, (2017), 7-8

³⁵⁴ Background Note by the Secretariat on Algorithms and Collusion, 21-23 June 2017, 50

³⁵⁵ Ariel Ezrachi and Maurice E. Stucke. "Sustainable and Unchallenged Algorithmic Tacit Collusion." *Northwestern Journal of Technology and Intellectual Property*, vol. 17, no. 2, (2020), 256-259.

the costs of over-intervention should also be considered³⁵⁶. So it is crucial to find a balance between “competition policies and the needs of the market”³⁵⁷.

Regarding the debate on liability, it is necessary to note humans are the ones designing algorithms, set the moment they will run independently and can turn off the machine even though the machine can operate in various ways which can be unpredictable sometimes³⁵⁸. So undertakings should estimate the alteration in market structures and the potential risk of decreasing competition as a result. On the other hand, it does not appear any other responsible party other than undertakings instructing and using algorithms that cause collusion in the end.

To conclude, the development of the legal framework is “an urgent task”³⁵⁹ realizing we cannot foresee what is about to come when it comes to technology. However, since we cannot initially start from the legislation, it is crucial to improve our understanding of the functioning of pricing algorithms and develop effective remedies to foresee the main risks and their possible solutions. Before algorithmic collusion becomes a strategy for firms with anti-competitive intentions they must be refrained from this with effective measures and be careful about what they employ and benefit meaning it will not be feasible to hide behind a computer.

³⁵⁶ Ibid

³⁵⁷ Ilgin Isgenc. "Competition Law in the AI ERA: Algorithmic Collusion under EU Competition." *Trinity College Law Review*, 24, (2021), 35-54.

³⁵⁸ Ana Posic and Adrijana Martinovic. "EU Competition Law in the Digital Era: Algorithmic Collusion as a Regulatory Challenge." *EU and Comparative Law Issues and Challenges Series*, 4, (2020), 1037.

³⁵⁹ Peter Georg Picht and Benedikt Freund. "Competition (Law) in the Era of Algorithms." *Max Planck Institute for Innovation & Competition Research Paper No. 18-10*, (2018), 4. SSRN

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