ANTITRUST ENFORCEMENT AGAINST CARTELS UNDER ART. 101 TFEU AND SMART ALGORITHMS: THE THREAT OF TACIT COLLUSION IN A DATA-DRIVEN ECONOMY

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The object of this work is to consider the different aspects that involve the e-commerce sector and new means used by companies to predict competitors' actions and plan the perfect business strategy.
The matter involves competition law because, with the continuous development of artificial intelligence, pricing algorithms – programmed to deliver the most profitable price at which goods should be sold – are reaching a level of independence that could allow them to make decisions independently: in order to develop the most profitable business strategy, they could realize that it is advantageous to adjust their prices to those of the competitors, giving birth to a situation that brings the same effects of a cartel, but cannot be called so because both a meeting of minds or wills, or even an actual contact between firms or algorithms, lack.
The work provides an initial examination of the tools available to the competition authorities, such as investigations, whistleblowing and leniency programs, which, however, would prove ineffective when facing the action of pricing algorithms.
In Chapter 2, the legal framework available in the EU is analysed, trying to understand which glimmers leave Article 101 TFEU so that it can be identified in which category tacit algorithmic collusion can be traced.
In the absence of any kind of contact or mutual intent, this form of tacit collusion cannot be brought under the category of agreement. Then, it seems plausible that the versatile concept of concerted practice may include it. Furthermore, the work examines the criteria available to see whether there are indeed negative effects and – while remaining very unlikely – whether the exemption of Article 101(3) can apply.
In Chapter 3, the work approaches the operating techniques of pricing algorithms, starting from the concept of Big Data. A definition of it is drawn up, since it has attracted great interest and concerns throughout the legal world. One of the issues raised by Big Data is whether, through the process carried out by the algorithms, it can facilitate tacit collusion. Big Data is a set of information, which vary in quantity and quality, exchanged at high speed and of great value, that acts as a sort of "fuel" for the algorithms and makes the market transparent allowing consumers' needs and desires to be identified efficiently by companies.
The more developed types of algorithms, *i.e.* machine learning and deep learning, are explored. Machine learning algorithms work in a dynamic environment, learning through trial and error, from an initial instruction and data given by the programmer.
The results of a study conducted on how a type of machine learning algorithms work in an oversimplified duopoly environment, in which the algorithms can only choose between a high and a low price for each period, are reported. In the experiment, a collusive situation occurs every 160.000 periods, thus keeping open the possibility that, in the real market – certainly more varied and complex, but also with faster exchanges – the pricing algorithms implemented by companies could actually collude independently to return the most profitable price requested.
Challenges arise because it is difficult to use the current tackling tools when collusion takes place without there being any exchange between the algorithms or the companies. Even more problematic – if not impossible – would be if companies used deep learning algorithms, that work with greater abstraction and present themselves as an opaque black box, so that it is impossible to go back over the process followed by the algorithm, in order to verify that an anti-competitive conduct actually took place.
In Chapter 4 the work discusses that the introduction of these algorithms that adjust prices to the competitors' with a zero-lag response changed the market. Algorithms are able to monitor their competitors constantly: they modify market conditions and make tacit collusion stable, by increasing transparency. The same effects derive from exchange of information that can be considered as a form of concerted practice because of its ability to eliminate strategic uncertainty that grants a competitive market.
Thus, a strong connection and similarity can be seen between exchange of information and the outcome of the monitoring and zero-lag price adjustment by smart algorithms. Although a real contact between algorithms does not take place, the effects are the same. Therefore, there is room for a change in the interpretation of the ECJ, so that algorithmic pricing can be caught as a concerted practice.
Even though algorithmic pricing could be considered illegal, the problem of detecting such forms of cartels still remains. A promising option would be auditing the algorithms in a beta environment, in order to understand how they work.

Although it is not easy to decipher which are the steps taken by the algorithms, studies are proceeding toward the creation of machine learning algorithms that give explanations for their behaviour (and the same could be imagined for deep learning).
Finally, the work focuses on countermeasures that would tackle algorithmic tacit collusion.
Enforcers could monitor how algorithms and the market react to the introduction of a delay for the frequency of price adaptation, destabilizing the zero-lag price adjustment factor.
Another countermeasure could be the sponsoring of State-controlled maverick algorithms that destabilize the cartel.
Then, a promising proposal implies the design of algorithms that comply with competition rules by being instructed to do so. However, there are some obstacles to overcome, such as transforming competition policies into automation code and the need for a general participation by all the players in the game.
Antitrust enforcement can overcome these challenges only with commitment for developing suitable tools for fighting collusion between algorithms.