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研究課題名（和文）Artificial Intelligence, Price Setting Strategies and Antitrust Law: Towards a Regulatory Framework

研究課題名（英文）Artificial Intelligence, Price Setting Strategies and Antitrust Law: Towards a Regulatory Framework

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研究成果の概要（和文）：本研究では、価格敏感情報の単なる伝達を禁止する競争法が、あらゆる種類のAIによる談合に適用できることを発見した。 さらに、そのような競争法が起業家に法の遵守を義務づければ、責任を逃れることは困難であろう。また、透明な情報に基づいて動作するAIは、談合する可能性が高い。価格決定AIのさらなる監査によってこの結果が確認されれば、談合のリスクを規制するのがよいだろう。特にネット通販のプラットフォームではそうだろう。また、本研究では、AIによる談合について判断する前に、アルゴリズムを正しく理解することが必要であることが強調された。この点で、我々はUberがAIによる談合のケースではないと主張した。

研究成果の学術的意義や社会的意義
Competition laws with broad and flexible prohibitions are more likely to appropriately deal with algorithmic collusion. The Japanese competition law does not fit this finding. Furthermore, collusion by algorithms is likely on online retail platforms. Regulating this risk is better than punishing.

研究成果の概要（英文）：The research has responded to the question of whether competition law can respond to algorithmic collusion. The answer to this question depends on 1) the conceptualization of the competition law and 2) the correct understanding of the operation of an algorithm. Competition laws, that recognize concerted practices without adding any other requirement and impose a responsibility to comply with the law, can be applied to any kind of algorithmic collusion. If a competition law is not applicable to cartel facilitators, many types of algorithmic collusion can escape the law. Auditing algorithms is an alternative enforcement tool, but too complex and time consuming. The research therefore suggests to regulate the risk of algorithms operating with transparent information, which is information readily available to everyone. Algorithms operating on opaque information pose less risk for algorithmic collusion, unless information is explicitly shared or stolen.

研究分野：Competition Law

キーワード：algorithmic collusion　cartel　Uber　algorithmic auditing　concerted practice　online retail　digital economy　price setting

様　式　Ｃ－１９、Ｆ－１９－１、Ｚ－１９（共通）

１．研究開始当初の背景

The reason for this research lies in the conundrum regulators and enforcers face when dealing with artificial intelligence (AI) as it is difficult to predict its evolution and associated risks. Despite its uncertain nature, it is clear that AI will continue to progress. Without a clear understanding of the evolution and the risks, regulators and enforcers lack an objective basis to design an appropriate legal framework or enforcement strategy for AI induced collusion. That there is a lack of understanding is visible in the early antitrust scholarship on this issue.

There was, on the one hand, a debate holding that AI could result in collusive price setting, even in non-concentrated markets. The ease with which such a collusion could be established makes these scholars argue for a revision of antitrust law and theory. In the end, this form of collusion resembles tacit collusion and that is, as of now, not punishable under current antitrust law. There were, on the other hand, also arguments stating that buyers could undermine AI collusion strategies by using technology or holding that AI would not lead to collusion.

Because of this dichotomy in viewpoints, this research has dealt with the question of how antitrust regulators and enforcers should deal with AI driven collusive pricing strategies.

２．研究の目的

This research had three different purposes. First, the research aimed at questioning algorithmic homogeneity. It was generally assumed that the use of AI will always lead to collusion. The research has contended that such is not likely as long as the data on which the AI runs is opaque to others. Second, the research intended at investigating whether traditional competition law is adequate to deal with algorithmic collusion. The research has found that current competition law is sufficiently adept to deal with algorithmic collusion on the condition that the law could be applicable to concerted practices and to cartel facilitators. Third, the research was designed to see whether alternative models of regulation need to be considered by the antitrust enforcers. This research has found that auditing is a particular helpful regulatory tool to achieve proper antitrust enforcement.

３．研究の方法

The research applied a desktop study. The desktop aimed at summarizing the debates on algorithmic collusion in order to map out the different views on algorithmic collusion. This research is justified in that it explores the current literature and reveals the gaps to be filled.

Besides, the research employed a comparative research. The comparative research has been done to see to what extent the competition laws of various jurisdictions are able to deal with algorithmic collusion. The jurisdictions we have reviewed are Australia, China, the European Union, India, and Japan. The choice is justified because the European Union has a broad conceptualization of agreement and concerted practice and some case law. Australia, China, and India have adopted reforms to their respective competition laws to cover concerted practices. Japan is peculiar in that it has separate provisions on horizontal and vertical agreements, making it difficult to extend the law to hub-and-spoke cartels and cartel facilitators.

Furthermore, the research has applied empirical case studies. On the one hand, the research has engaged with case studies in which the workings of algorithms were reverse engineered in order to link that scientific outcome with legal implications. On the other hand, the research has been able to rely on a study of an online retailer.

４．研究成果

Mapping the research results

The research has started from the observation that Ariel Ezrachi and Maurice E. Stucke have presented a taxonomy to facilitate discussions on algorithmic collusion within the competition law community. Despite identifying four models of algorithmic collusion (“Messenger, Hub and Spoke, Predicable Agent and Digital Eye”)**, the focus of the debate on algorithmic collusion has primarily been on scenarios where algorithms autonomously reach collusive outcomes, thus the two last-mentioned scenarios. This focus has sparked discussions on whether algorithms can collude independently and how competition law should address such independent collusion. These two questions have led to two separate strands in the debate: a technological one and a legal one.**

The technological debate is experimental and none of the experiments has shown that algorithms can collude in a real-time world. The experimental research has therefore

contributed to a wide variety of speculations. Some scholars hold that algorithms could result in pricing strategies other than algorithmic collusion. More dramatically formulated, but in line with the previous view, is the suggestion that algorithms will never be able to collude in a real-world scenario. To prevent speculation, a part of the debate has advocated the auditing of existing algorithms or testing algorithms before being released on the market.

The legal debate has been characterized from the beginning by a big divide. On the one hand, there are scholars arguing that competition law is up to the task. On the other hand, there are those scholars maintaining that competition law needs to change. The call for change can be divided between re-interpreting existing concepts and introducing new concepts. A more drastic option that has been suggested was to create regulatory instruments outside the traditional competition law framework.

Within the technical and legal debate, the research has contributed to the existing literature and scholarship with the following findings:

1) A flexible (broad) legal framework

One of the major research questions asked in this research is the applicability of competition law to algorithmic collusion. It has already been indicated above that answering this questions requires answering the question of whether the pricing information is readily available for other algorithms to use (transparency) and correctly qualifying the conduct. Once it is obvious that there can be tempering with the price setting and it has been decided how the prices are tempered with, the applicability of competition law can be judged.

In case of Uber, we have already determined that it is likely not a case of algorithmic collusion. However, there is a tempering of the price going from the operator of the algorithm to its drivers. As this could not be qualified as RPM, the applicability of a competition law depends on whether it allows for other qualifications. The AMA has this flexibility due to the presence of UTPs. One of these UTPs, trading on restrictive terms, allows the application of the AMA to cases unqualifiable as an RPM but still fixing the maximum resale price.

UTPs are not the only necessity to deal with algorithmic price setting. The European Union (EU) practice shows that a competition law focusing on communication is also essential. This is translated in the EU by accepting communications and expressions of price sensitive information and awareness that the communicated information is price sensitive. The EU does not require proof of intent; in other words, it is not important on whether the information was shared with the aim of price fixing. If this kind of flexible description of the infringement is combined with a responsibility to put safeguards in place against infringements, as is the case in the EU, the competition law may even be able to catch implementers of the most advanced self-learning algorithms.

This is understood in Australia, where the Harper Reform has led to the inclusion of concerted practices. Even though there are some positive signs that this concept would be able to tackle algorithmic collusion, it is pointed out that the Australian concept requires proof of at least a likely effect of substantially reducing competition. This may create an impediment for effectively dealing with algorithmic collusion.

In China and India, there has been an evolution towards recognizing that a cartel does not only involve trading partners. The algorithmic collusion debate has speeded up this recognition. In other words, cartel facilitators and hub-and-spoke cartels were possibly outside the scope of their respective competition laws. In China, this could be explained by separating the horizontal and vertical agreement in two different provisions within the competition law. Japan has a similar problem. India, though regulating horizontal and vertical agreements in the same provision, did not explicitly recognize the extension of its cartel provision to facilitators. China and India changed their law, while Japan did not.

Summary: any competition law formulated more narrow and less flexibly than the one in the European Union will be less likely to cover any type of algorithmic collusion. Unfair trade practices could compensate for such a narrowly and inflexibly formulated competition law

2) *Transparent versus opaque data*

Algorithms have introduced new possibilities for businesses, such as optimizing price setting (as seen with Amazon) and establishing innovative business models (as exemplified by Uber). However, there is a lack of understanding regarding the behavior

of these algorithms, which poses challenges for regulatory authorities and other stakeholders. Developing appropriate enforcement policies requires a deeper comprehension of these algorithms. Our research has focused on engineering studies that have audited the algorithms of Uber and Amazon Marketplace to attach legal conclusions to such algorithms. The engineering studies used were the ones conducted by Le Chen, Alan Mislove, and Christo Wilson.

The engineering studies identify two types of information sources on which the algorithms operate: transparent and opaque. Transparent information is the one that can easily be scrapped of the internet. It is possible to obtain this kind of information without engaging into lengthy reverse engineering processes. An online retail platform is a good example, whereby the price setting is noticeable for everyone, including technology. Opaque information is information not available to the public at large. It can that can only be obtained through reverse engineering the algorithm or bluntly 'stealing' **the information.**

The empirical research shows that transparent information facilitates tacit collusion among competitors, raising concerns about the need for regulatory intervention to mitigate the risks associated with transparency. The auditing also reveals that transparent algorithms can enhance efficiency, potentially leading to higher prices. While this may not necessarily be problematic, it could be exploited as part of an overall predatory strategy. In contrast, tacit collusion is less likely in the case of opaque information. However, if transparency is artificially created within an opaque information setting, for example by stealing information, it opens up the possibility of achieving other pricing strategies, including collusion but also exclusionary tactics.

Auditing algorithms in business models operating with opaque information demonstrates that explicit collusion can be challenging, as it requires group consensus among the users of the algorithm and a comprehensive understanding of how the algorithm functions. Moreover, even if collusion is achieved, its effects are typically short-lived.

Summary: algorithms are more likely to collude on the price when they operate on publically available data than when they operate on obscure data. Furthermore, once algorithms collude, an upward trend on prices is visible.

Auditing algorithms

The research has shown that auditing algorithms is a useful tool for reaching a proper understanding of the conduct that the algorithm engages in. The research has shown that the Uber algorithm can hardly be regarded as leading to conclusion. An opposite conclusion has been drawn for the algorithm on Amazon Marketplace. However useful, implementing audits come at a cost for the antitrust enforcers. In case of Uber, reverse engineering was necessary. In case of Amazon Marketplace, the behavior of the algorithm had to be studied over a long period of time. It is thus questionable whether auditing algorithms is an appropriate alternative investigative tool for antitrust enforcers. If more empirical research would be available, regulating the risk of the algorithm may be more appropriate than regulating the harm. This may be particularly appropriate for algorithms that operate based upon transparent readily available price information. For algorithms that operate based on opaque pricing information, an ex post regulation, thus of the harm instead of the risk, may be sufficient.

Arriving at the decision to regulate the risk will require some substantial auditing of algorithms. The most obvious algorithms to audit are the ones operating on online retail platforms. However, in a real world setting, this has proven to be difficult. Collusion screening tests do not automatically reveal collusion. This could relate to the sheer size of the online retail market or the presence of both algorithmic and non-algorithmic sellers.

Summary: auditing may be an excellent alternative enforcement tool, but is complex and time consuming. If collusion is omnipresent in a sector, regulating the risk may be better than waiting for the harm to be punished.

Questioning the taxonomy: Uber and hub-and-spoke

In the early literature on algorithmic collusion, little criticism was directed towards the algorithmic collusion taxonomy of Ezrachi and Stucke ("Messenger, Hub and Spoke, Predicable Agent and Digital Eye")**. The structure of the taxonomy was widely adopted, sometimes with different terminology, while the content remained largely unchanged, with only minor adjustments made. Even in current literature, the taxonomy continues**

to hold influence. For instance, in 2021, the Study Group on Competition Policy in Digital Markets, commissioned by the Japan Fair Trade Commission, utilized the taxonomy to assess the applicability of the Japanese Antimonopoly Act (AMA) to various scenarios of algorithmic collusion.

The research has pointed out that there is a need to question some of the taxonomy. Because the literature had already questioned the predictable agent and digital eye as anti-competitive scenarios, this research has questioned the Uber-like algorithm as a hub-and-spoke cartel. Having indicated why the qualification as a membership agreement, a joint venture agreement, a resale price maintenance (RPM) agreement, a subcontracting agreement, and an agency agreement could not apply to the Uber algorithm, we have pointed out that the current scholarship is merely speculative on the application of hub-and-spoke, even to the extent that this classification is applied because none of the others apply.

Uber's business model must be analyzed to see whether one of the above designations **could apply. Two services have been highlighted in the literature. First, Uber offers brokerage between drivers and riders. The platform allows drivers to show their availability while permitting riders to request a ride from one point to another. Second, Uber also offers a price-setting service, which drivers cannot refuse. The price-setting** service is always to be included in the driver's subscription package. It offers advantages **to both drivers and riders; drivers are certain about the payment, while riders are gua**ranteed a fair price. A driver cannot charge more than the Uber algorithm's **calculation; however, the opposite might be possible. In other words, the algorithm fixes the maximum price for a ride.**

Since the research has already mentioned that RPM does not apply to this situation, only competition laws that have provisions regulating maximum price setting outside the scope of RPMs can deal with this kind of algorithmic price setting. The research has indicated that, for Japan, this would be possible if the Japan Fair Trade Commission relies on the dealing on restrictive terms, an unfair trade practice (UTP). This UTP applies to the factual situation wherein a supplier imposed a price on a retailer without reselling a product could be applied. Even if this UTP is applies, it could be argued that pro-competitive effects, including tremendous inter-brand competition or the avoidance of double marginalization, could outweigh the restrictive terms.

Summary: debate on algorithmic collusion requires a proper understanding of when an algorithm is colluding. If the algorithm is not colluding, other provisions of a competition law may be applicable.

Understanding the taxonomy: the competing firm trap

There are, mainly in Asia, competition laws that separate the regulation of horizontal and vertical agreements into different provisions. The horizontal agreement provisions are in such competition laws often limited to agreements between competing undertakings. Cartel facilitators, non-competing undertakings helping the cartel, are often excluded from the application of this kind of competition laws.

These documents are often conceptualized using the taxonomy of Ezrachi and Stucke on algorithmic collusion. But, when interpreting the taxonomy, the scenarios are often explained in function of the existing competition law. For example, in the Japanese report on algorithmic collusion, the predicable agent scenario has been explained as the management of competing firms turning to the same algorithm to implement future changes of a human-made cartel agreement or as a third-party algorithm developer may sell the same algorithm to competing firms without them knowing it. Yet, it is possible that the algorithm developer or a third party implements the algorithm. By neglecting this kind of scenarios, an incorrect statement will be given on whether the respective competition law is sufficiently able to deal with algorithmic collusion.

Summary: public policy instruments should avoid conceptualizing an algorithmic collusion taxonomy in which the algorithms are implemented by competing firms. A narrow taxonomy will not lead to a sufficient understanding on the applicability of a competition law on colluding algorithms.

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2019年

〔図書〕　計3件

1．著者名 Steven Van Uytsel, Mark Fenwick, Bi Ying	4．発行年 2020年
2．出版社 Springer	5．総ページ数 230
3．書名 Regulating FinTech in Asia Global Context, Local Perspectives	

1．著者名 Steven Van Uytsel	4．発行年 2021年
2．出版社 Springer	5．総ページ数 225
3．書名 The Digital Economy and Competition Law in Asia	

1．著者名 Steven Van Uytsel, Salil K. Mehra, Yoshiteru Uemura	4．発行年 2023年
2．出版社 Edward Elgra	5．総ページ数 280
3．書名 Algorithms, Collusion and Competition Law: A Comparative Approach	

〔産業財産権〕

〔その他〕

Conference Website: Collusion, Algorithms and Competition Law
https://vanuytselsteven.wixsite.com/algorithmcollusion

Conference Website: Multidisciplinary Perspectives on Algorithms
https://vanuytselsteven.wixsite.com/website-4

6．研究組織

	氏名 （ローマ字氏名） （研究者番号）	所属研究機関・部局・職 （機関番号）	備考

7．科研費を使用して開催した国際研究集会

〔国際研究集会〕　計2件

国際研究集会	開催年
Collusion, Algorithms and Competition Law	2019年～2019年
国際研究集会	開催年
Multidisciplinary Perspectives on Algorithms: Regulation, Governance and Markets	2019年～2019年

8．本研究に関連して実施した国際共同研究の実施状況

共同研究相手国	相手方研究機関			
オーストラリア	Deakin University			
ベルギー	Antwerp University			
ドイツ	Frankf. School of Finance and Management			
中国	Chinese Academy of Soc. Sciences			
シンガポール	ISEAS-Yusof Ishak Institute			
米国	James E. Beasley School of Law	John Hopkins University		
インド	Institute of Law of Nirma University			