Articles

Revisiting the notion of agreement in Australian cartel law in the algorithm-driven economy

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Pricing algorithms pose a conceptual and practical challenge for competition law. This article revisits the notion of agreement in Australian cartel law in the context of the algorithm-driven economy. It examines legal and academic approaches in the European Union, the US and the UK before applying these insights in the Australian context. The article focuses particularly on two kinds of pricing algorithms that pose challenges for Australian cartel law, namely parallel and signaling algorithms. We argue that parallel algorithms should be understood as falling within the concept of agreement for cartel law, although they present evidentiary challenges. Signaling algorithms, by contrast, constitute concerted practice under Australian law. They could also potentially fall within the cartel prohibition, but this would require empirical evidence of de facto collusion in the relevant market.

I Introduction

Pricing algorithms have increasingly become part of daily life. They produce significant economic efficiencies, providing firms with more effective pricing models to accommodate customised services, optimising the allocation of resources and benefiting customers as well as overall social welfare.[1] However, they also risk effectively forming price-fixing cartels, even without any formal agreement or human interaction. Pricing algorithms are supported by real-time data, through the input of a set of tokens or objects used to generate outputs under mechanical or systematic rules.[2] The use of real-time data increases market transparency, contributing to the strong predictive capacity of algorithms. By facilitating frequent digitalised price adjustments, algorithms function as an 'intermediary' between firms, allowing immediate coordination of prices.[3] Consequently, algorithms can implicitly replace the traditional negotiation approaches for price-fixing cartels.

Cartel law is primarily designed to regulate anticompetitive conduct resulting from human behaviour patterns.[4] However, algorithms enable new forms of coordination. Competitors who agree on a common policy normally

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1 Michal Gal, 'Algorithms as Illegal Agreements' (2018) 34(1) *Berkeley Technology Law Journal* 67, 70.

2 Robert A Wilson and Frank C Keil, *The MIT Encyclopedia of the Cognitive Sciences* (Massachusetts Institute of Technology Press, 1999) 11.

3 Salil K Mehra, 'Antitrust and the Robo-Seller: Competition in the Time of Algorithms' (2016) 100(4) *Minnesota Law Review* 1323, 1334–5.

4 Gal (n 1) 76.

demand a guarantee to bind and monitor adherence to this shared goal. Algorithms, by contrast, render it unnecessary to reach these formal agreements among competitors, instead allowing the use of tacit strategies. These tacit strategies may include adopting the same third-party algorithms among competitors, setting maximised profit targets within algorithms for homogenous products in a particular market or applying updated data to accurately predict rivals' actions.[5] Furthermore, pricing algorithms are capable of prompt retaliation for participators' profitable deviations.[6] The powerful data mining capacity of algorithms can easily distinguish intentional deviations from natural pricing reactions. Such identification enables forcible restraint by punishing deviators to strengthen price-fixing cartels.

Algorithmic scenarios are a frontier as well as a powerful challenge for competition law.[7] Since the US Department of Justice ('DOJ') charged David Topkins, the founder of an online poster retailer, with algorithmic collusion for coordinating the pricing of posters on Amazon, more and more cases concerning pricing algorithms have been investigated by competition authorities globally.[8] The topic has also gained increasing academic attention, although relatively little work has been done from an Australian standpoint.[9] This article situates Australian cartel law against the background of pricing algorithms to revisit the notion of agreement. It proceeds by comparatively examining legal and academic approaches in the European Union ('EU'), the US and the UK, before applying these insights in the context of Australian legislation and practice.

The new features of algorithm-related cartels described above have posed challenges to identify and classify the types of communication applicable to price decisions in the digital market. Algorithms were influentially classed into four types by Ariel Ezrachi and Maurice Stucke.[10] Subsequently, the Organisation for Economic Co-operation and Development ('OECD') has offered a non-exhaustive list of the possible roles of algorithms as facilitators of collusion.[11] The OECD provides a list of four categorised roles: monitoring,

5 Sumit Singh Bhadauria and Lokesh Vyas, 'Algorithmic Pricing and Collusion: The Limits of Antitrust Enforcement' (2019) 8(2) *Nirma University Law Journal* 87, 95–6.

6 Ibid 102.

7 Maurice Stucke, 'Pricing Algorithms & Collusion' (2019) 20(3) *Transactions: The Tennessee Journal of Business Law* 1113, 1114.

8 For discussion, see Salil K Mehra, '*US v Topkins*: Can Price Fixing be Based on Algorithms?' (2016) 7(7) *Journal of European Competition Law and Practice* 470.

9 The main exceptions are work by Rob Nicholls and Brent Fisse, along with a recent article by Deniz Kayis. However, these analyses focus primarily on the evidentiary and enforcement challenges posed by algorithmic collusion, rather than underlying conceptual issues. See, eg, Rob Nicholls and Brent Fisse, 'Concerted Practices and Algorithmic Coordination: Does the New Australian Law Compute?' (2018) 26(1) *Competition and Consumer Law Journal* 82; Deniz Kayis, 'Do Androids Dream of Electronic Collusion? An Analysis of Algorithmic Collusion under Australian Law' (2021) 29(3) *Australian Journal of Competition and Consumer Law* 176.

10 Ariel Ezrachi and Maurice Stucke, *Virtual Competition: The Promise and Perils of the Algorithm-Driven Economy* (Harvard University Press, 2016) chs 5–8 ('*Virtual Competition*').

11 Organisation for Economic Co-operation and Development ('OECD'), *Algorithms and Collusion: Competition Policy in the Digital Age* (Report, 2017) 24 ('*Algorithms and Collusion*').

self-learning, parallel and signaling algorithms. The role of monitoring algorithms is to collect and process information from competitors, to detect and monitor the rivals' pricing actions, and eventually to retaliate to any deviations from an agreed price.[12] Their function is to automatically avoid unnecessary price wars. Monitoring algorithms of this kind fall squarely within the existing hard core cartel provisions, since the agreed price remains an explicit communication among competitors.[13] The crucial evidentiary issue is to identify programmed deviation patterns which may be hidden in the algorithms.[14]

Self-learning algorithms, by contrast, essentially raise novel issues in another field. Machine learning and deep learning technologies enable these algorithms to learn optimal pricing strategies. This type of algorithm raises issues about how to attribute liability for the social costs of artificial intelligence, since no collusion is necessary for them to distort the market. From the perspective of technology neutrality, individuals enjoy the freedom to select the most appropriate technologies for commercial use, within the general constraints posed by the existing legal principles.[15] Arguably, without any kind of anticompetitive agreement or intent, competitors should not be liable for an ostensibly anticompetitive outcome.[16] However, the alternative view argues that algorithm developers and/or operators, who benefit from the algorithms, should be accountable for such outcomes due to the distribution of social costs. This is an interesting and controversial issue raised by self-learning algorithms, but it falls outside the scope of this article.

Parallel and signaling algorithms, the other two types identified by the OECD, have produced grey areas in identifying the illegality of anticompetitive conduct, particularly in relation to the notion of agreement. For this reason, the following parts of this article will focus primarily on parallel and signaling algorithms, although comparisons with monitoring and self-learning algorithms may also be drawn where appropriate. The article begins by considering the existing notion of agreement in Australian cartel law, which requires coordination among competitors leading to a 'meeting of minds'.[17] However, the adoption of parallel and signaling algorithms occupies an ambiguous region between cartel conduct and conscious parallelism, which is legally permitted. Algorithmic parallelism involves a kind of tacit collusion based on the intermediary function of parallel and signaling algorithms. The appropriate definition and legal significance of the indirect communication involved in this tacit collusion needs to be probed by categorised analysis.

12 Ibid 26.

13 Kayis (n 9) 180.

14 Ibid 181–2.

15 See generally Brad A Greenberg, 'Rethinking Technology Neutrality' (2016) 100(4) *Minnesota Law Review* 1495.

16 For discussion of the normative role of intent in cartel prohibitions, see Jonathan Crowe and Barbora Jedličková, 'What's Wrong with Cartels?' (2016) 44(3) *Federal Law Review* 401 ('What's Wrong with Cartels?'); Barbora Jedličková and Jonathan Crowe, 'Exclusionary Conduct in Competition Law: A Consequence-Sensitive Deontological Account' (2021) 12(2) *Jurisprudence* 123 ('Exclusionary Conduct in Competition Law').

17 'Anti-Competitive Conduct', *Australian Competition and Consumer Commission* (Web Page) <https://www.accc.gov.au/business/anti-competitive-behaviour/anti-competitive-conduct> ('Anti-Competitive Conduct').

The subsequent parts of the article conduct this analysis by focusing in turn on the types of communication involved in parallel and signaling algorithms. Parallel algorithms occur where competitors adopt the same algorithmic platform in their relationships with a common supplier, resulting in a 'hub-and-spoke' arrangement that coordinates the competitors' actions. The legal assessment of this kind of scenario in the US and UK allows us to recognise two crucial elements of tacit communication by algorithms, namely algorithmic reliance and information exchange. We argue that the existing notion of agreement in Australian cartel law can cover this kind of situation, although evidential difficulties arise. Signaling algorithms, on the other hand, occur where agents do not adopt the same algorithm or platform, but rather set the same profit maximising target exercised by algorithms independently, creating the problem of the so-called 'predictable agent'.[18] The existing approach in Australia would define this conduct as concerted practice, which is limited to civil penalties, rather than cartel conduct. We argue that the use of signaling algorithms could also potentially fall within the notion of agreement for the cartel prohibition, but this would require empirical evidence of de facto collusion in the relevant market.

II Tacit collusion in pricing algorithms

Cartels are prohibited due to their significant negative impact on economic and consumer welfare and attract serious criminal and/or civil penalties.[19] One of the explicit elements of the prohibition on cartels is reaching an anticompetitive agreement, specified in the *Competition and Consumer Act 2010* (Cth) ('*CCA*') as a 'contract, arrangement or understanding'.[20] Australian cartel law has set clear guidelines for identifying the establishment of an agreement. However, challenges arise in applying these principles to algorithmic collusion.

A Express communication in the existing notion of agreement

Section 45 of the *CCA* prohibits competitors from making any 'contract, arrangement or understanding' that 'has the purpose, or would have or be likely to have the effect, of substantially lessening competition'. Section 45AD further defines such an agreement as a 'cartel provision' if it has certain purposes and effects, including price-fixing purposes achieved by fixing, controlling or maintaining prices. Sections 45AF, 45AG make it a criminal offence to enter into or give effect to a cartel provision. Substantial monetary penalties apply.

Each of the substitutable forms of agreement under s 45 of the *CCA* — namely, a 'contract, arrangement or understanding' — deliberately sets up coordination among competitors while maintaining the illusion of

18 Ezrachi and Stucke, *Virtual Competition* (n 10) ch 7.

19 *Competition and Consumer Act 2010* (Cth) pt IV div 1 ('*CCA*'). For discussion of the rationales for prohibiting cartels, see Crowe and Jedličková, 'What's Wrong with Cartels?' (n 16): Jedličková and Crowe, 'Exclusionary Conduct in Competition Law' (n 16).

20 See, eg, *CCA* (n 19) s 45.

competition.[21] A contract refers to a formal agreement to collude, whereas arrangements and understandings may be less formal. Arrangements involve the acceptance of mutual rights and obligations by parties and will therefore typically be established through 'express negotiations between the parties'.[22] Understandings, by contrast, involve a common intention to maintain a state of affairs or course of conduct.[23] This can potentially be established through circumstantial inference.[24]

The moral wrongness of cartels, as one of the present authors has discussed elsewhere,[25] is best explained through a combination of deontological and consequentialist factors. Entities involved in a cartel convey mutual assurances that the commitment they have reached will be carried out. This agreement is deontologically wrong, because it involves an intention to violate evolved norms of competitive behaviour, which have beneficial consequences for the common good. In other words, the prohibition on anticompetitive agreement targets not only mutual understanding among firms but also how that mutual understanding was achieved, namely through methods manifesting an intention to thwart the norms of competitive conduct. The usual means of reaching an agreement is express communication. However, the existence of agreement can be proved by circumstantial evidence of meeting of minds. Lockhart J observed in *Trade Practices Commission v Email Ltd*:

> For there to be an arrangement or understanding there must be a meeting of minds ... In some cases this may be inferred from circumstantial evidence. There must be a consensus as to what is to be done and not just a mere hope as to what might be done or happen. Independently held beliefs are not enough.[26]

The challenge posed by the algorithm-driven economy is that competitors can easily maintain reciprocal interdependence without express communication. For instance, by applying the same third-party algorithms, competitors can obtain identical pricing strategies for their own price setting in a seemingly independent manner.[27] Alternatively, by analysing shared data to serve the same maximised profit target, firms can accurately predict or follow their rivals' pricing actions. This then leads one to ask: to what extent can the mutual understanding for using algorithms among competitors satisfy the requisite meeting of minds for an agreement? What is the difference, if any, between the inherent and rational adoption of algorithms in the pursuit of market profits, on the one hand, and reaching tacit coordination through the intermediary role of algorithms, on the other hand? To answer these questions, it is instructive to further explore a grey area between legally permissible parallel behaviour and illegal express collusion — namely, tacit collusion.

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21 'Anti-Competitive Conduct' (n 17).

22 *Australian Competition and Consumer Commission v Leahy Petroleum Pty Ltd* (2007) 160 FCR 321, 331–2 [26] (Gray J).

23 'Anti-Competitive Conduct' (n 17).

24 Ibid.

25 Crowe and Jedličková, 'What's Wrong with Cartels?' (n 16): Jedličková and Crowe, 'Exclusionary Conduct in Competition Law' (n 16).

26 (1980) 43 FLR 383, 385.

27 Bhadauria and Vyas (n 5) 91.

B The challenge of tacit collusion

Competition law is not designed to tackle any rational market strategy or pricing behaviour involving deliberately imitating competitors' actions by inferring their intention from accessible market materials, even if those conducts would cause an equivalent outcome to cartels by homogenising the market. This type of behaviour is often called conscious parallelism. As observed by the US Supreme Court, conscious parallelism itself does not contravene § 1 of the *Sherman Act*.[28] Donald Turner influentially argued that such parallelism is inherent and rational as response to specific market structures and should not be prohibited.[29] By contrast, deliberate collusion by explicit agreement is prohibited as a per se violation in the US or violation by object in the EU (as it is under Australian law).

Tacit collusion represents a grey area between these two categories. This concept refers to any anticompetitive coordination without explicit agreement but through some form of indirect communication to maintain parallel outcomes. Examples might include one firm's public announcement of its future pricing policy to the other firms with the expectation that they will follow suit or mutual pricing interdependence among competitors in a market facilitated by structured release of information. This distinction gives rise to three categories of conduct: legally permitted conscious parallelism, illegal explicit collusion and ambiguous tacit collusion.[30]

The application of parallel and signaling algorithms has further blurred the already tricky line between conscious parallelism and tacit collusion. Parallel algorithms refer to the unilateral adoption of algorithms by firms to monitor others' price settings as well as to automatise their own decision-making processes. This strategy behaves in a 'follow-the-leader' manner by relying on a single platform supplier (like the Uber ride-sharing system) or adopting a third-party algorithm independently but from the same provider.[31] Signaling algorithms create further possibilities. Firms can constantly send new price signals and collect others' signals through the powerful analytical tools of algorithms. This rapid interactive action would eventually converge towards a common price setting. Such use of algorithms is nothing more than the technical implementation of the company's own market presence, because the price 'negotiation' process exercised by algorithms is merely an instantaneous version of traditional price adjustment in a brick-and-mortar market. Nonetheless, the use of such algorithms can impact negatively on competition.

C Comparison to oligopolistic parallelism

Pricing algorithms enable indirect communication among competitors in arriving at a final common price setting, which may constitute tacit collusion.

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28 Reza Dibadj, 'Conscious Parallelism Revisited' (2010) 47(3) *San Diego Law Review* 589, 601; Alan Devlin, 'A Proposed Solution to the Problem of Parallel Pricing in Oligopolistic Markets' (2007) 59(4) *Stanford Law Review* 1111, 1122.

29 Donald F Turner, 'The Definition of Agreement Under the *Sherman Act*: Conscious Parallelism and Refusals to Deal' (1962) 75(4) *Harvard Law Review* 655, 671.

30 The prohibition on concerted practices under s 45 of the *CCA* can be seen as a response to this problem. We discuss this further in Part IV below.

31 OECD, *Algorithms and Collusion* (n 11) 38.

Nonetheless, the nature of inherent and rational responses to market conditions in an algorithm-driven economy may mean the parallel behaviour caused by pricing algorithms is legally unaccountable. This dilemma has occurred similarly to the classical 'oligopoly problem', which has analogous characteristics to the digital market.[32] The comparison to the oligopoly problem may help in recognising the challenges posed by pricing algorithms for the notion of agreement.

As mentioned above, explicit collusion is illegal due to the role of express communication, while conscious parallelism without such communication is arguably lawful, even if the price adjustments might be strikingly parallel. Normally, without express communication among competitors, it is unfeasible to reach a substantial degree of autonomous parallelism unless this phenomenon occurs in an oligopolistic market. The most essential aspect of oligopoly is the consciousness of each oligopolist's interdependence.[33] With fewer sellers, firms would rely on the high interdependence to take the actions of other competitors into account for deciding their own price adjustments. Based on this mutual self-awareness, firms would recognise the interest of the entire group for either maintaining a high price or avoiding vigorous price competition.[34] There are evident similarities between pricing algorithms and the oligopoly problem. Due to the highly concentrated and transparent market conditions that result from both phenomena, firms can impact each other significantly and monitor price deviations easily. Competitors can rely on this interdependence and repeated interaction to adjust prices, and potentially raise them to monopoly levels, without expressly communicating their intentions.

Richard Posner analysed the oligopoly problem as a grey area which might result in tacit collusion, but which falls outside the reach of competition law.[35] A robust debate has resulted on how competition law should react to this problem (if indeed there is a problem in the first place).[36] Robert Bork famously argued that the interdependence of oligopolists tends to be overstated and questioned whether antitrust authorities should interfere with them.[37] Alan Devlin, on the other hand, contends that the parallel effects of oligopoly spring substantially from an alternative form of meeting of minds and thus explicit communication can be proved from circumstantial evidence.[38] The extended competition law enforcement tools in some jurisdictions attempt to regulate this problem from a neutral position, through either merger control to prevent oligopoly structures from arising or

32 Catalina Gonzalez Verdugo, 'Horizontal Restraint Regulations in the EU and the US in the Era of Algorithmic Tacit Collusion' (2018) 7(1) *University College London Journal of Law and Jurisprudence* 114, 125–6.

33 Ibid 121.

34 Richard Posner, 'Oligopoly and the Antitrust Laws: A Suggested Approach' (1969) 21(6) *Stanford Law Review* 1562, 1564.

35 Ibid 1566.

36 For a helpful overview, see Richard Whish and David Bailey, *Competition Law* (Oxford University Press, 7th ed, 2012) 560–7.

37 Robert Bork, *The Antitrust Paradox: A Policy at War with Itself* (Free Press, 1993) ch 8.

38 Devlin (n 28) 1143–6.

prohibition of specific forms of unilateral conduct contributing to mutual interdependence.[39] Consequently, responses to the oligopoly problem remain fragmented and inconclusive.

Despite the similarities noted above, the algorithm-driven economy is significantly distinctive from an oligopolistic market. In a brick-and-mortar market, it is rare to observe the conditions for sustaining tacit collusion. The small number of exceptions may occur in a duopoly context with a high degree of market transparency as well as high barriers to entry.[40] Due to pricing algorithms, by contrast, structural characteristics and supply-side characteristics have changed in a wide range of contexts.[41] The occurrence of tacit collusion like that arising from oligopoly problem could become extraordinarily common.[42] Algorithms might expand the scope of such tacit collusion from similar contexts to the oligopoly problem to non-oligopolistic market structures. Furthermore, in addressing the oligopoly problem, the essence of the legal framework still lies in the notion of agreement. The US courts have taken the view that complaints evidencing tacit collusion or conscious parallelism need to establish an agreement was made or rule out the possibility that the defendants acted independently.[43] However, algorithms concentrate more on tacit communication by working as instruments that eliminate the need for traditional interaction between competitors, making it challenging to meet this evidentiary burden.

It follows that the best method to explore indirect communication among competitors for potential tacit collusion in the algorithm-driven economy is categorised analysis. Each scenario needs to be examined on its own terms to identify the proper legal response and highlight gaps in current approaches. Ezrachi and Stucke have outlined two challenging scenarios relating to parallel and signal algorithms respectively: 'hub-and-spoke' and the 'predictable agent'.[44] The following parts of this article consider the role of pricing algorithms in these two situations, explaining how tacit communication works to challenge and extend the existing notion of agreement in cartel law. We consider how each of these scenarios fits into the current Australian law, highlighting conceptual and practical challenges.

III Tacit communication in hub-and-spoke arrangements

Horizontal and vertical restraining arrangements are regulated under clear-cut rules in most competition regimes. Generally, horizontal agreements like cartels are viewed with great suspicion for causing detrimental harm through

39 OECD, *Competition Enforcement in Oligopolistic Markets* (Issues Paper, 16–18 June 2015) 19.

40 Jan Potters and Sigrid Suetens, 'Oligopoly Experiments in the Current Millennium' (2013) 27(3) *Journal of Economic Surveys* 439, 460.

41 OECD, *Algorithms and Collusion* (n 11) 20–1.

42 Ariel Ezrachi and Maurice E Stucke, 'Sustainable and Unchallenged Algorithmic Tacit Collusion' (2020) 17(2) *Northwestern Journal of Technology and Intellectual Property* 217, 221.

43 Dibadj (n 28) 591.

44 Ezrachi and Stucke, *Virtual Competition* (n 10) chs 6–7.

collusion among competitors in the same market level, which would be treated as a per se violation in the US or an object violation in the EU. Vertical restrictions are also widely recognised on a case-by-case analysis for their anticompetitive effects among different market levels, which are typically assessed under a rule of reason in the US or an approach based on specific competitive effects in the EU. However, hub-and-spoke arrangements are a combination of these two forms implemented through vertical restrictions among actors occupying different market levels to reach substantial horizontal coordination. This less straightforward form of collusion has been categorised differently in diverse national contexts. This part analyses the jurisprudence in the US, UK and EU to examine the nature of tacit communication by algorithmic information exchanges and revisit the notion of agreement in Australian cartel law.

A Hub-and-spoke arrangements

The algorithmic hub-and-spoke arrangement is set by the relationship between supplier and user. Competitors adopt the same platform from a common supplier and rely on the algorithms provided by this single player. The competitors play the role of spokes who are controlled and supplied with the same platform as their central hub. There are two types of cases that have been identified in the case law from other jurisdictions. The first is exemplified by the Uber ride-sharing service.[45] The Uber platform is applied by all the Uber drivers to synchronise uniform fares and therefore restrict price competition between them. This parallel use is based on the actual knowledge that all the other Uber drivers have adopted the same platform, which would in turn cause every new joining driver to follow the same fare. The second scenario is represented by the Eturas travel bookings platform in the EU.[46] The service provider here uses a spontaneous hub produced by the parallel synchronisation of information from all platform spoke users to advance the objective of maximising profits for participants. The tacit coordination can be proven because the spokes can be presumed to be aware of or have reasonably foreseen the parallelism, and do not expressly distance themselves from the resulting risk.

When the central platform uses an algorithm to calculate the profit maximisation for all competitors to align the prices, this could potentially be considered a hard core cartel arrangement among the competitors, because the platform merely plays the role of intermediate or facilitator between the colluding agents. Alternatively, it can be viewed as a typical hub-and-spoke arrangement if there is no direct communication among the platform users, but a common understanding to coordinate prices can be established. The distinction between these analyses depends on the specific market characteristics used to determine the nature of the tacit collusion. However, in both situations, the effect on the market is the same. As regards detection, pricing coordination facilitated through algorithms still requires some form of

45 *Asociación Profesional Élite Taxi v Uber Systems Spain* (Court of Justice of the European Union, C-434/15, ECLI: EU:C:2017:981, 20 December 2017).

46 *'Eturas' UAB v Lietuvos Respublikos Konkurencijos Taryba* (Court of Justice of the European Union, C-74/14, EU:C:2016:42, 21 January 2016).

direct communication on the operation of the platforms. These communications need to be transmitted to reach an agreement between the hub provider and the spoke operators, if not among the spokes themselves, although there might be less of a 'paper trail' as algorithms can convey the detailed information in a faster and more accurate way. In this sense, the challenge for competition law is one of effective enforcement, as multiple interrelated factors need to be considered to build an overall picture.

The current enforcement approaches vary across jurisdictions. In the US, a class action against Uber for making a price-fixing agreement with drivers through its algorithm settings was dismissed in arbitration. Uber's mandatory arbitration clause prevented the matter from being decided in court.[47] By contrast, the Competition Authority in Luxembourg found in the similar case of *Webtaxi* in the EU that algorithmic price collusion was restricting competition by object under art 101(1) of the *Treaty on the Functioning of the European Union* ('*TFEU*').[48] However, art 101(3) provides for an efficiency justification, which is that without this type of uniform price-fixing, the service would not interest customers. The Competition Authority applied an exemption under this provision. In other words, the nature of the hub-and-spoke arrangement is a competition infringement by object, but the exemption eliminated the liability otherwise imposed on the supplier.

B The inference standard in the US and algorithmic reliance

Hub-and-spoke arrangements consist of a series of parallel vertical agreements connecting to the same central hub. Only when these legally permitted vertical restrictions establish the 'rim' around the spokes to bridge each competitor in the same level can illegal horizontal arrangements be established. The existence of the rim therefore determines the nature of the overall coordination potentially giving rise to a per se violation under US antitrust law. In other words, the indirect communication among spokes, on the condition of establishing the rim, would turn the uncertain link among competitors into a cartel-standard agreement. The US jurisprudence has generated an inference standard to illustrate the existence of the rim as well as how the rim works in parallel vertical relationships.

A series of cases exemplify this inference standard. In *Interstate Circuit Inc v United States*,[49] the spoke level movie theatres had the knowledge that all the other competitor theatres had received or would receive identical letters from the hub interstate movie exhibitor. Based on this information, competitors accepted the requirement from the letter which created their unanimity of action without any other rational and benign motive. In this way,

47 *Meyer v Kalanick*, 174 F Supp 3d 817 (SD NY, 2016). The case was dismissed by the arbitrator on 22 February 2020. See Tina Bellon, 'Uber Customer Claims Company Won Price-Fixing Suit because Arbitrator Was Scared', *Reuters* (online, 23 May 2020) <https://www.reuters.com/article/us-uber-lawsuit-idUSKBN22Y2ZZ>.

48 *Treaty on the Functioning of the European Union*, opened for signature 7 February 1992, [2009] OJ C 115/199 (entered into force 1 November 1993); Décision nº 2018-FO-01 du 7 juin 2018, *Concernant une procédure au fond mettant en cause Webtaxi S.à.r.l.*

49 306 US 208, 227 (1939).

the rim can be inferred. A more recent case is *Toys 'R' Us Inc v Federal Trade Commission*[50] where it was alleged that a toy retailer communicated to toy manufacturers through 'shuttle diplomacy' and assured them of the same intention of other manufacturers. Along with the evidentiary fact of fewer sales to warehouse clubs, which was contradictory to rational business policy, the court held the rim could be inferred from indirect communication and circumstantial factors. A further case for this standard is the Apple e-books case.[51] Apple conducted a series of parallel but independent vertical agreements with publishers. The results of such negotiations included the assurance of identical agreements being made with other publishers. This collective understanding elevated Apple's actions to a per se violation.

Other cases demonstrate the limitations imposed by the inference criteria, even if the form of the indirect communication appears very similar. In *PepsiCo Inc v Coca-Cola Co*,[52] Pepsi alleged that Coca-Cola's uniform arrangements with food service distributors constituted per se illegal hub-and-spoke coordination, particularly since Coca-Cola assured distributors access to exclusive products and encouraged them to report any violation. The court dismissed this claim because the arrangement neither fixed the price of the products nor restricted the competition among these distributors. In this sense, the gist of hub-and-spoke cartels is the restriction effect among spoke level competitors rather than the effect on competition between the hub and its rivals. The function of the overall arrangement should be an instrument for spoke level competitors to reach an agreement indirectly by tacit communication.

Similarly, where a platform provides pricing algorithms for users to calculate the uniform price for products or services, the pricing algorithms play the hub role to all spoke users in reaching an agreement. Due to the intermediary roles of algorithms, such as monitoring, self-learning, paralleling and signaling functions, indirect agreement among users can be reached and guaranteed on the knowledge that all other competitors would also set the same price. Therefore, the tacit communication in algorithmic hub-and-spoke cartels is not any assurance from the hub in independent vertical agreements to competitors. However, the explicit reliance on the pricing algorithms, once unilateral adoption of the algorithms has reached a certain level, may be sufficient to establish tacit agreement among competitors. In a traditional brick-and-mortar market, the inference evidence focuses on the competitors consciously choosing to accept the vertical agreement which might lead to price-fixing effects at the horizontal level. In a digital market, by contrast, such circumstantial evidence should focus more on the foreseeable awareness of the unified price which relies upon the information contributed by each algorithm user.

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50 221 F 3d 928 (7th Cir, 2000).
51 *United States v Apple Inc,* 952 F Supp 2d 638 (SD NY, 2013).
52 315 F 3d 101 (2nd Cir, 2002).

C The state of mind test in the UK and algorithmic information exchange

In the UK, the crucial question remains what establishes the link between two vertical entities for information exchange and therefore their tacit communication. The approach adopted by the UK is to analyse these relations in terms of a triangular relationship of A-B-C.[53] The spoke competitor A discloses any future pricing intentions to the hub B, B passes the information on to spoke C, and C uses this information to determine its own pricing behaviour. In this way, the collusion between spokes A and C can be reached by the intermediary role of hub B. Therefore, exchanging the information is the conduct which conveys the tacit communication between A and C. If this information exchange is materially and deliberately committed by hub B, then hub B is the facilitator of tacit collusion between A and C. The disclosing behaviour of A and corresponding reaction of C should be assessed by an additional subjective element regarding the state of mind test. Namely, A must have the intention to specifically communicate the information to B for the purpose of passing it on to a certain C (or any unknown C). Meanwhile, C must know under what circumstances B has obtained the information from A. In other words, the intentions of each actor, the conducts that have been observed and knowledge of the relevant circumstances are linked together to establish a concerted action among A, B and C.

The case of *Tesco Ltd v Office of Fair Trading*[54] has provided helpful insights by the Competition Appeals Tribunal into the state of mind test. A had expressly declared that unless the other retailers would undercut its prices, A would accept the cost increase of the ingredients supplied by B and thus increase its retail prices. Under this state of mind, A transmitted the statement to B. Meanwhile, there was no legitimate business reason for this price setting transmission, such as any vertical requirement through different market levels. Furthermore, A 'may be taken to intend' based on circumstantial evidence that this information would be passed on to other retailers to influence market conditions on the retail price.[55] Finally, C did nothing to refuse this information but accepted it as the material to determine its own future price.

The state of mind test raises a debatable issue as to whether the interpretation of the 'intention' of A should be 'actual foresight' or 'reasonably foreseeable'. This matter has not been determined in the existing UK cases, but recent jurisprudence by the European Court of Justice ('ECJ') sheds some light on it. Reasonable foreseeability is a lower standard which would amount to constructive knowledge. In *VM Remonts*, the ECJ ruled that a service provider may be liable if they reasonably foresee the anticompetitive acts from competitors and accept this risk.[56] Another issue is the state of C's mind concerning to what extent C's subsequent pricing reaction is determined by A's information obtained from B. A few factors may affect C's choice, for

53 *Argos Ltd v Office of Fair Trading* [2006] EWCA Civ 1318, [141] (Lloyd LJ); *Tesco Ltd v Office of Fair Trading* [2012] CAT 31, [57] ('*Tesco*').

54 *Tesco* (n 53).

55 Ibid [69].

56 *SIA 'VM Remonts' v Konkurences Padome* (Court of Justice of the European Union, C-542/14, ECLI:EU:C:2016:578, 21 July 2016) [31].

instance, the credibility of messenger and facilitator hub B, the market power of A, as well as the economic influence of A's pricing information. However, these factors contribute to the motive of C's choice rather than the objective construction of C's collusive intention. Ultimately, where both A and C satisfy the state of mind test, their tacit communication in terms of hub-and-spoke collusion can be established.

In the context of algorithms, it seems that the platform as the original provider expressly or impliedly discloses the future pricing strategy to all the subsequent spoke users by offering the algorithm for adoption by members of the user group. Any user can then be taken to disclose its pricing intention by the conduct of adopting the same algorithm, which is similar to the role of spoke A. Any subsequent user is the spoke C since it obtains direct or indirect knowledge of the information expressed from a known or unknown spoke A through the information exchange in the same algorithm. Although additional factors such as market structures or economic incentives in a digital market also should be considered,[57] they are merely contributing to the motive of the spokes' conduct rather than their collusive intention.

The key point in this analysis is the function of information exchange from the hub B using pricing algorithms. One of the advantages of algorithms is the continuous price changes facilitated by their automatic nature. Price comparison websites provide consumers opportunities to compare the available offers and determine the best selections. They also mean that information of all the competitors' price settings is accurate and reliable, not only for consumers but also for competitors. Dynamic pricing exercised by algorithms requires real-time data including pricing information from every accessible competitor. In this sense, the same or identical algorithms adopted by competitors play the role of hub B to collect the information from one competitor and pass it on to others. Meanwhile hub B, either the algorithm developer or the platform itself, is the facilitator of tacit collusion by any competitor who satisfies the state of mind test — namely, whether a competitor who adopted the same algorithm may be taken to intend that its pricing information would be passed on to other competitors, and the other competitors do nothing to refuse such information but accept it as the material to determine their own future pricing.

D Revisiting the notion of agreement in Australian cartel law

We saw previously that Australian cartel law requires a meeting of minds, which is typically established through express communication, although circumstantial evidence can also be utilised in the case of an understanding. The Federal Court has shown a willingness to find illegal collusion in traditional hub-and-spoke scenarios involving express communication between the hub and the spokes, but not the spokes themselves. For example, in *News Ltd v Australian Rugby Football League Ltd*,[58] the Australian Rugby

57 Gian Luca Zampa and Paolo Buccirossi, 'Hub and Spoke Practices: Law and Economics of the New Antitrust Frontier?' (2013) 9(1) *Competition Law International* 91, 110.

58 (1996) 64 FCR 410.

Football League (the hub) asked its member clubs (the spokes) to sign commitment agreements. The clubs did so within a short period and in the knowledge that other clubs were entering substantially identical agreements. This was enough to establish a common undertaking among the spokes even though they did not communicate directly. Similarly, in *Trade Practices Commission v David Jones (Australia) Pty Ltd*,[59] the Sheridan Manchester company (the hub) convened a meeting of retailers (the spokes). The subsequent pricing strategies gave rise to an inference of a common purpose among the spokes even without evidence of express collusion.

The methods of analysis used to address hub-and-spoke cartels in the US and the UK provide further beneficial insights to Australian cartel law. The notion of agreement in Australian law can be viewed in light of the inference standard applied in the US and the 'state of mind' test from the UK. The US approach evaluates the degree of algorithmic reliance among competitors through economic and marketing analysis to infer collusion between them. Meanwhile, the UK test assesses the collusive participators' subjective mentality regarding the existence of an agreement, basing this if necessary, on circumstantial evidence. Specifically, information exchange is a confirmed function of pricing algorithms which has already reached common sense status in the context of a digital market. In this sense, agreement may be taken to exist in hub-and-spoke arrangements in the form of tacit communication. These analytical tools adopted in other jurisdictions can potentially equip Australian law to face the conceptual challenges posed by algorithmic hub-and-spoke arrangements, although significant evidentiary issues remain.

The main conceptual challenge this approach poses to existing Australian law lies in the idea that algorithmic collusion may arise based on a common understanding even without express communication of the understanding either between the hub and the spokes or among the spokes themselves. This may arise where the hub provides an algorithm and the spokes adopt it with the understanding that it will facilitate coordination of prices. Indeed, as suggested previously, the hub in this scenario may be the algorithm itself rather than any third party. However, the gist of hub-and-spoke coordination, as we argued previously, lies in the collusion of the spokes to fix prices rather than the coordinating role of the hub per se. The crucial element of the illicit behaviour is therefore the common purpose of the spokes, which can potentially be inferred from the adoption of the algorithm, provided it can be shown or inferred that this was done with a collusive intention.

The evidential complexities that may arise in such scenarios are illustrated in the Australian context by the traditional hub-and-spoke case of *Australian Competition and Consumer Commission v Colgate-Palmolive Pty Ltd.*[60] Cussons and other laundry detergent manufacturers had simultaneously made changes to their product range in circumstances that raised a suspicion of collusion. However, the limited number of direct communications between the manufacturers, either directly or through the alleged hub (the Woolworths grocery chain), meant collusion could not be proved. It was also argued that the changes in products could be explained as a rational response to market

59 (1986) 13 FCR 446.
60 [2019] FCAFC 83.

forces. The case illustrates the difficulty of inferring collusion from parallel conduct where there is limited direct communication and complex market conditions. This challenge could also afflict some cases of algorithmic collusion, but the problem is a practical rather than conceptual one and does not differ in kind from the traditional evidentiary challenges of such cases as illustrated by the detergent litigation.

IV Concerted practice and the predictable agent

Hub-and-spoke arrangements derive uniform pricing behaviour from the adoption of the same platform or algorithm, which is like the traditional supplier and retailer relationship. This means that existing legal analyses provide significant insights to construct the elements of tacit collusion and thereby adapt the notion of agreement contained in Australian cartel law. However, if competitors merely adopt third party algorithms independently, which can be portrayed as rational profit maximising behaviour or the freedom to select the most appropriate technologies for commercial use, then would any tacit communication still exist among competitors? This scenario raises the issue of the predictable agent.

A The predictable agent of pricing algorithms

As explained by Ezrachi and Stucke, the 'predictable agent' refers to the situation where multiple competitors adopt the same algorithm-driven profit maximising strategy without necessarily dealing with a common supplier or adopting the same algorithmic platform.[61] Pricing algorithms employ the predictive analysis of real-time data to maximise profits for users. The predictable agent can function well to provide pricing strategies by data sharing among algorithms, rather than any traditional communication among competitors. This new form of negotiation is conducted by repeated assessment and adjustment of prices. In this way, the more reliance is placed on algorithms, the higher the degree of market price transparency that will occur, and the more likely it is that the prices will eventually be unified.

Another notable characteristic of the predictable agent is the speed of price adjustment. Whenever any competitor shifts online prices, algorithms can probe it and then make their own pricing decisions within milliseconds. This kind of rapid adaptation is dramatically distinguished from traditional price adjustment. The more advanced the algorithm is, the more profitability it can bring. Also, the sooner these advanced algorithms are adopted, the more profitable opportunity is possible. The increasing adoption of pricing algorithms within a specific market therefore has the potential to cause an algorithmic arms race. Rational competitors would adopt pricing algorithms in a proactive manner and every user would rest in the position of collecting others' prices and immediately determining their own reactions. This would produce a highly transparent and homogenous market.

Individually speaking, such behaviour is reasonable as a rational market strategy, as well as a similar process to traditional price wars. However, the

61 Ezrachi and Stucke, *Virtual Competition* (n 10) ch 7.

simultaneous algorithmic price adjustment makes competitors reach a substantially unified price in a rapid manner, which is very similar in form to an agreement of fixed price. Furthermore, the speed of price adjustment in fact excludes the normal participation of consumers from the perspective of supply and demand. The synchronous price adjustment restricts consumers' ability to select products, eliminating the element of trial-and-error risk in competition. In other words, competitors can set a seemingly reasonable price merely through algorithmic communication rather than by actual market competition. As mentioned above, the remaining competition lies in competing to adopt more effective algorithms, as well as the race to update the existing ones. This potentially distorts the process of competition in the long term.

Whether such algorithmic uniformity of pricing is legally accountable is, of course, another topic. Having regard to the characteristics of the predictable agent discussed previously, along with their potential anticompetitive effect, the approach of 'concerted practice' has been raised by EU scholars based on art 101(1) of the *TFEU*.[62] This idea has also been discussed by the Australian Competition and Consumer Commission ('ACCC') in its *Guidelines on Concerted Practices*.[63] The position of the predictable agent under Australian law is considered further in the following sections.

B Anticompetitive concerted practices

Section 45 of the *CCA* prohibits concerted practices for the crucial reason that conduct which has the effect of 'substantially lessening competition' is economically detrimental.[64] Distinguished from the existing notion of agreement as 'meeting of minds', as well as tacit communication identified by the 'state of mind' test, concerted practice involves any communication that is more than an independent response to market conditions or any form of cooperation in place of the uncertainty of normal competition.[65] Generally, concerted practice is aroused by the disclosure of commercially sensitive information through any intermediary, such as a common trade association among distributors. The rationale of this concept rests on the idea that competitors should practice their own independent determinations and therefore should not engage in a concerted practice that has a purpose or effect of substantially lessening competition. These two elements play an important role in identifying the establishment of concerted practice.[66]

The formal nature of concerted practice cannot be specifically defined, as it is hard to exhaustively capture the scope and possible applications of the concept. However, a general description with some identifying factors can be provided.[67] The degree of uniformity among competitors is a primary consideration, although it may not be determinative. Similar pricing strategies

62 See, eg, Maik Wolf, 'Algorithm-Based Pricing in Online Retailing as Concerted Practice: Covering the "Predictable Agent" with Article 101(1) TFEU' (22 November 2019) *Social Science Research Network* 9 <https://ssrn.com/abstract=3536959>.

63 ACCC, *Guidelines on Concerted Practices* (Report, August 2018).

64 Ibid 3.

65 Ibid.

66 Ibid.

67 Ibid 4.

are signals that draw the attention of competition authorities and serve as the first sight of any tacit collusion or conscious parallelism. Concerted practice also frequently involves the exchange of strategic information by making such information more quickly accessible, more readily processed and/or more reliably obtained. Due to the disclosure of such commercial information, the conduct does not arise as an independent reaction to market conditions but is better characterised as alignment behaviour.

Concerted practice also typically involves more tacit means of communication than traditional forms of anticompetitive conduct. This communication may occur, for example, in public statements (even to the media), in formal or informal price settings, or with the involvement of agents or other intermediaries.[68] Concerted practice may be inferred in some circumstances from not only a pattern of concurrent behaviour, but also a uniliteral information disclosure from one party to any other known or unknown competitors. The notion of concerted practice therefore has the capacity to encompass a wide range of communication methods, providing a powerful tool for recognising novel forms of anticompetitive coordination.

The other crucial element of concerted practice is an effect-based consideration — namely, whether the conduct has the purpose or effect of substantially lessening competition in a relevant market. Section 45(1)(c) of the *CCA* defines 'purpose' as the intention to achieve a particular result. The crucial issue is therefore the purpose of the concerted practice — that is, the result sought to be obtained — rather than the motive for engaging in such practice.[69] The relevant purpose may be established by either direct evidence or circumstantial inference. Purpose, with its reference to intention, is a subjective notion. Effect, by contrast, refers to the direct consequence of a practice which is determined by the actual impact objectively considered. Case law has defined the notion of 'substantial lessening competition' as being 'meaningful or relevant to the competitive process',[70] having regard to seriousness of the adverse effect on competition, particularly with consumers in mind.[71]

The effect-based element of 'substantially lessening competition' plays a crucial role in identifying concerted practices, due to the concept's uncertain scope. The starting point is therefore generally an assessment of the relevant market including the market power of the respective parties. After that, the further step is to assess whether the practice is exercised in an interdependent manner rather than based on independent decisions, in the sense that the common nature of the contributing factors described previously has materially replaced or reduced the competitive and independent decisions of competitors. Based on these two steps, the parallel behaviour exercised through the common adoption of pricing algorithms for predicting and unifying prices can be assessed within the framework of anticompetitive concerted practice. This legal analysis is carried out in detail in the next section.

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68 Ibid 6.

69 Ibid 7.

70 *Rural Press Ltd v Australian Competition and Consumer Commission* (2003) 216 CLR 53, 71 [41].

71 *Universal Music Australia Pty Ltd v Australian Competition and Consumer Commission* (2003) 131 FCR 529, 585 [242].

C Legal assessment of the algorithmic agent

Does the predictable algorithmic agent substantially lessen competition? This question can be answered through an analogy with price-fixing as a recognised form of anticompetitive conduct. The process of dynamic pricing exercised by the algorithmic agent is not targeting predetermined prices but rather aiming to sustain the uniformity of market prices in real time. In this way, algorithmic users can prevent other rivals from gaining an advantage from their lower price settings as well as avoiding the disadvantages arising from the cost of price wars. Therefore, the effect of price-fixing in the algorithmic context does not depend on the form of a uniform price but is essentially determined by the principle of maximising profits. Although the overall assessment of the predictable agent will depend upon the relevant market, as well as the other strategies employed, the price-fixing effect of algorithms will tend to produce an analogous outcome to traditional cartels.

The anticompetitive character of cartels, as discussed previously, is due to the detrimental results of economic harms, breaching the moral duties of common good and the distortion of competitive values.[72] However, from the perspective of microeconomics, the outcome of price-fixing itself is dangerous because of the nature and market functions of prices. Prices are the measure of exchange value.[73] The ratio of exchange in terms of commodities requires a common denominator to scale values objectively. If price-fixing exists in a leader-and-follower manner, it distorts the foundations of equivalent exchange by producing an incommensurate price outlet. This imposes costs to consumers and results in economic maladjustments. In this respect, prices cannot be arbitrarily fixed or followed either by governmental and private monopoly in the past or algorithmic intermediaries in the future without undermining the value of competition and thereby the common good. Due to these negative impacts, the predictable agent is 'substantially lessening competition', which is consistent with the requirement for concerted practice.

Pricing algorithms, except for self-learning algorithms, cannot literally make decisions independently, placing them within the scope of concerted practice. Meanwhile, users of such predictable agents need not make separate pricing decisions after getting the algorithmic suggestions. Nor are they likely to do so given increasing algorithmic reliance and the demands of simultaneous pricing reactions. Subsequently, the interdependence of price-setting would inevitably reach a higher level. Some scholars argue this is caused by the inherent features of algorithm-driven markets and, as such, interdependent decisions in this context should be justified in a similar way to the oligopoly problem.[74] However, as we explained before, pricing algorithms raise questions beyond the market conditions of oligopoly. The reasons for interdependence cannot be universally rationalised. Taking a step back, even if the dilemma of oligopoly can be applied to pricing algorithms, the nature of

72 Crowe and Jedličková, 'What's Wrong with Cartels?' (n 16): Jedličková and Crowe, 'Exclusionary Conduct in Competition Law' (n 16).

73 Friedrich A Hayek, 'The Use of Knowledge in Society' (1945) 35(4) *American Economic Review* 519, 526–7.

74 Wolf (n 62) 12 n 76.

oligopoly remains nevertheless controversial. Thus, the interdependent market structure is not a complete defense for parallel price decisions.

The analysis of interdependent decisions shifts next to how users determine prices through the algorithmic agent. The ACCC has provided a few examples of traditional concerted practices to identify the process of reaching parallel price settings. The first instance involves using circumstantial evidence to prove consistency between personal contact and price decisions.[75] There are two directors, representing two independent but competing corporations in a market, meeting once a quarter for charitable purposes and regularly talking after those meetings. Evidence shows that they discussed a few business arrangements and one corporation subsequently acted in a generally consistent manner with these discussions. Moreover, one corporation decided to align with the price of the other due to some indirect disclosure of relevant internal information by the second corporation. Combining all this evidence, concerted practice rather than independent decisions can be identified.

A second example further illustrates the process of price alignment through exchanging sensitive information.[76] Bank A disclosed its intention to increase the rate of loan interest in an internal information-circulating system, prior to formal disclosure to the market. Other banks in this system did not provide their arrangements in return but their rates shifted broadly in line with Bank A continuously over time. Another case is a group of petrol retailers who occasionally call each other which can involve notifying each other of future pricing intentions.[77] The retailers did not reject these calls but consciously acted to ensure the conversations occurred in secret with the outcome of price following. Even if no express agreement to collude can be established, this practice involved foreshadowed and interdependent price adjustment and therefore falls within the ambit of concerted practice.

These examples show that any form of association among competitors can potentially facilitate anticompetitive coordination in a concerted manner, especially where it involves exchanging sensitive information. A common risk in these circumstances is follow-the-leader pricing, which replaces the uncertainties of competition to the benefit of all parties and therefore can be used to infer their anticompetitive purpose. The predictable algorithmic agent is a mechanism designed to exchange price-related information. Reliance is placed on the assumption that the disclosure of information would be reciprocated by other competitors and then the expectation or intention can be inferred to undermine competitive conduct.

The novel form of association occurring through pricing algorithms can therefore be categorised as concerted practice by drawing analogies with these previously considered examples. This potentially allows the application of the sanctions outlined in s 76 of the *CCA*. Notably, however, the punishment of concerted practice is limited to civil sanctions under the existing legislation. In other words, concerted practice is not sufficient to prove an explicit agreement and thus it cannot satisfy the requirements to establish cartel conduct, which attracts criminal sanctions. A further question might therefore

75 ACCC (n 63) 9.
76 Ibid 11.
77 Ibid 11–12.

be asked: are there any additional factors that can analogise concerted practice to an agreement and potentially bring it within the scope of cartel law? What perspective should competition authorities then use to assess coordination through algorithmic agents? We suggest in the following section that further empirical research is needed to adequately answer these questions.

D Gaps between concerted practice and cartels

Due to the uncertain scope of concerted practice, its identification relies on a circumstantial method to infer the competitors' purpose or intention to engage in such practice. This is distinct from the notion of tacit communication that can be applied to hub-and-spoke arrangements. Due to the negative economic impact of price-fixing, the pricing freedom of competitors is restricted to protect social welfare in a long run. Similarly, in the algorithmic economy, the freedom to choose advanced technologies should be limited, unless a new consensus is reached that pricing algorithms and like technologies serve some higher welfare goal. Algorithmic price-coordination, like traditional cartels, harms consumer welfare by undermining competition. The consequentialist justifications for prohibiting cartels therefore largely apply to pricing algorithms. However, the deontological element of cartel conduct — namely, that participants knowingly undermine the common good — is hard to prove without explicit communication between the parties.

If it could be shown to be common knowledge among sellers in a specific market that pricing algorithms play a coordinated price-fixing function by dynamically sharing information among competitors, then the decision to use algorithms alongside competitors (even if not through a common platform) would evince at least a presumptive intention to participate in a price-fixing scheme, satisfying the deontological element. The mutual intention to fix prices would become like the agreement between spokes in a hub-and-spoke scenario and therefore the adoption of the pricing algorithm would be enough to establish the meeting of minds required by cartel offences. It is an empirical question whether this level of knowledge of algorithms has been reached in any given market. Attributing responsibility on this basis would require further study of the technological character of algorithms in a specific market, their economic effects on prices and competition, and knowledge and understanding of those consequences among competitors.

It is possible that in some scenarios, the collusive intention required to establish cartel conduct could be established by evidence such as communications between competitors about the role of algorithms or information provided to users by the algorithmic platforms about their functions and effects. However, users of pricing algorithms would have an interest in professing innocence about their anticompetitive effects and might maintain they are simply a useful tool to adopt rational pricing strategies and respond to a rapidly changing market. They might further maintain ignorance about how the algorithm works and what information it shares with competitors. Without explicit agreement to fix prices or tacit collusion proved by circumstantial evidence, participants in concerted practice should not bear the serious sanctions of cartels, as the deontological element cannot be established. Nevertheless, circumstantial evidence of agreement de facto can

potentially be used to evaluate the predictable agent and bridge the gap between concerted practice and cartels. The question is whether gathering this evidence would be worthwhile when the alternative mechanism of concerted practice is available and more easily established.

V Conclusion

Pricing algorithms set prices through some form of indirect communication among competitors in arriving at their final common price setting, which may constitute tacit collusion. However, the nature of inherent and rational responses to market conditions in an algorithm-driven economy may mean the parallel behaviour caused by pricing algorithms is legally unaccountable. The notion of agreement in Australian cartel law typically requires explicit communication among participants, but circumstantial evidence can also be relied upon in the case of an understanding. We have argued that this concept can be understood as covering parallel algorithms, which involve a kind of tacit collusion, analogous to traditional hub-and-spoke arrangements. Signaling algorithms, on the other hand, raise the problem of the predictable agent, which allows price coordination without direct communication or even a common platform. This conduct could qualify as concerted practice under Australian law. It could also amount to cartel conduct if a price-fixing intention can be proven. However, establishing this would require targeted empirical investigation.

Pricing algorithms illustrate the complexity of contemporary technology-driven markets and the difficulties of applying and enforcing competition law in this rapidly changing context. However, they also provide an illustration of the moral and conceptual components of cartel offences. Cartel conduct is properly distinguished from other forms of anticompetitive behaviour by its deontological component — that is, it requires an intention to collude, proven by explicit or tacit agreement, as well as anticompetitive consequences. This deontological aspect is indispensable given the seriousness of cartel offences, but it need not necessarily be established based on express or direct communication between the parties. We have argued that both parallel and signaling algorithms may, in at least some cases, be normatively equivalent to cartels in both consequentialist and deontological aspects. The difficulty lies in proving that participants have the knowledge required to show an intention to collude even in the absence of direct communication.