ANALYZING ECONOMIC INCENTIVES IN "HUB-AND-SPOKE" CONSPIRACIES

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ANALYZING ECONOMIC INCENTIVES IN "HUB-AND-SPOKE" CONSPIRACIES

By Celeste Saravia & Laurien Gilbert

This article provides an economic framework for analyzing incentives in "hub-and-spoke" conspiracies — arrangements that blend horizontal and vertical market relationships. Models of hub-and-spoke conspiracies involve participants at different supply chain levels (e.g. multiple manufacturers and a single distributor) whose interests may diverge. We categorize these conspiracies into four distinct classes based on the types of participants and where market power is primarily enhanced: (1) conspiracies that primarily harm competition in the market served by the vertical hub; (2) conspiracies that primarily harm competition in the market served by each of the horizontal participants; (3) conspiracies that harm competition in the market served by both vertical and horizontal participants; and (4) the emerging class of "algorithmic collusion" involving software providers that allegedly facilitate collusion as one of their core functions, which are similar to hub-and-spoke conspiracies in that not all participants are horizontal competitors.

The article explores the economic incentives of vertically-related participants to facilitate conspiracies that seem, at least facially, designed to produce outcomes that are contrary to their economic interests. Understanding these underlying incentives is a critical part of an economic analysis of hub-and-spoke conspiracy allegations

I. INTRODUCTION

In most alleged conspiracies, the conspirators operate at the same level of the supply chain. For example, a group of manufacturers could form an agreement under which each limits its output, or a group of retailers could agree to set a price floor for a particular product. Such conspiracies are often referred to as "horizontal" conspiracies. The economic incentives in horizontal conspiracies are often straightforward: by reducing competition among themselves, the conspirators can collectively exert market power and earn supracompetitive profits. Economic evidence in these matters is often brought to bear to address whether market conditions are conducive to an effective conspiracy, and whether outcomes are more consistent with competition (i.e. whether outcomes are consistent with firms acting independently) or with the alleged collusion.[2]

Some alleged conspiracies, however, involve participants at different levels of the supply chain. These are often labeled "hub-and-spoke" conspiracies, in which a central entity (the "hub") has vertical relationships (the "spokes") with multiple, competing firms (the "rim"). The hub may be either "upstream" or "downstream" of the rim participants. For example, the hub could be a common distributor for competing manufacturers, a powerful retailer for its suppliers, or, in a modern context, a software provider for competing service firms. The feature that distinguishes these conspiracies from purely horizontal conspiracies is the blend of horizontal and vertical relationships. Hub-and-spoke agreements are also distinct from purely vertical restraints (including parallel conduct in which multiple participants at the rim level enter into similar but *independent* vertical agreements with the hub), because the participation of multiple market participants at the rim level is assumed to increase their joint market power.[3]

In these arrangements, the economic incentives of the participants are less obvious. Participants operating at different levels of the supply chain may have different economic interests regarding the intended outcomes of the conspiracy. Why would a distributor want its suppliers to form a cartel and thereby raise its own input costs? What incentive does a software company have to knowingly facilitate price-fixing among its customers? Moreover, when the conspiracy involves vertically-related participants, a natural economic question is whether the horizontal "rim" agreements appear to be necessary to accomplish the aims of the conspiracy, or whether the same outcomes could have been realized through a series of vertical relationships.

Recently, several legal cases have alleged what is loosely referred to as "algorithmic collusion": alleged exchanges of competitively sensitive information and, in some cases, alleged efforts to coordinate on price, between a group of conspirators at the same level of the supply chain and a software service provider that functions as a coordinator. For example, ongoing litigation involving rental property management software providers RealPage and Yardi and hotel property management software provider Cendyn involve allegations that a software company that offered services to assist property managers in setting prices and managing inventory served as a vehicle for the exchange of competitively-sensitive information.[4] These cases are sometimes characterized as alleged hub-and-spoke conspiracies because they involve a group of horizontal competitors and a service provider serving as a coordinator.[5] A noteworthy distinction from typical hub-and-spoke allegations in these cases is that, broadly speaking, facilitating the conspiracy is allegedly intertwined with the core service the hub (the software provider) offers to the rim participants. Nevertheless, as in other forms of alleged conspiracy, the incentives of all participants to collude, including those of the software provider, remain a critical component of the economic analysis.

As we discuss, two common economic explanations for participants operating at different levels of the supply chain entering a conspiracy together are *avoiding punishment* and *rent-sharing.* The economic logic of the *avoiding punishment* explanation is that the primary

2 Note that the term "collusion" in economics refers broadly to a set of market outcomes in which, as the result of the strategic interaction between firms, the market price exceeds a relevant competitive benchmark. The terms "explicit collusion" and "tacit collusion" are sometimes used to distinguish between the types of explicit agreements prohibited by the antitrust laws and tacitly collusive strategies and outcomes that do not necessarily involve any explicit agreements between firms. Massimo Motta, *Collusion and Horizontal Agreements*, in Competition Policy: Theory and Practice 138 (2004). Discussions of hub-and-spoke conspiracies typically focus on settings in which there is at least an allegation that some degree of explicit collusion has taken place between the participants.

3 Margaret C. Levenstein and Valerie Y. Suslow, *How Do Cartels Use Vertical Restraints? Horizontal and Vertical Working in Tandem*, 83 Antitrust L.J. 15 (2020); John Asker and C. Scott Hemphill, *A Study of Exclusionary Coalitions*, 83 Antitrust L.J. 99 (2020).

4 See e.g. *United States of America et al., v. RealPage, Inc.*, No. 1:24-cv-00710-LCB-JLW (M.D.N.C Jan. 7, 2025); *Duffy v. Yardi Sys. Inc.*, No. 2:23-cv-01391-RSL (W.D. Wash. Dec. 4, 2024); *Cornish-Adebiyi, et al. v. Caesars Entertainment, Inc., et al.*, No. 1:23-CV-02536-KMW-EAP (D. N.J. Sept. 30, 2024); *Gibson v. Cendyn Group LLC*, No. 2:23-CV-00140-MMD-DJA (D. Nev. May 8, 2024). Ongoing litigation against Agri Stats, a data company, includes related allegations that Agri Stats' business model was to serve as a vehicle for exchange of competitively-sensitive information by its clients in the meat processing industry. *United States et al. v. Agri Stats*, No. 0:23-cv-03009-JRT-JFD (D. Minn. Nov. 15, 2023).

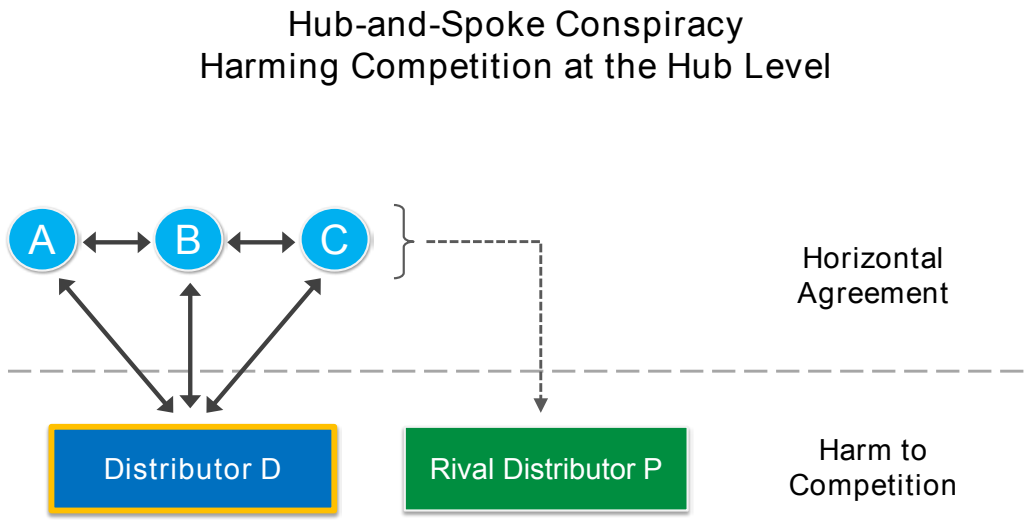
5 See for example, David C. Kully & Kenneth Racowski, *DOJ Introduces New Twist in Algorithmic Collusion Cases*, Holland & Knight (Aug. 26, 2024), https://www.hklaw.com/en/insights/publications/2024/08/doj-introduces-new-twist-in-algorithmic-collusion-cases; *RealPage Antitrust Cases Face Significant Hurdles*, Clifford Chance (Sept. 25, 2024), https://www.cliffordchance.com/insights/resources/blogs/group-litigation-and-class-actions/2024/09/realpage-antitrust-cases-faces-significant-hurdles.html.

beneficiaries have bargaining power over the facilitating participants at a different level of the supply chain that they leverage to induce their participation. The *rent-sharing* explanation requires that the primary beneficiary(ies) of the agreement share the supra-competitive profits with participants who are facilitating the agreement.

Understanding the incentives underlying the relationships between the horizontally- and vertically-related participants is critical to an economic analysis of the allegations in a particular alleged conspiracy. We distinguish between four classes of conspiracies based on where in the vertical chain the market power is primarily enhanced and the types of participants. We then delve into the economic incentives for each class.

II. CLASS ONE – CONSPIRACY PRIMARILY INCREASES MARKET POWER AT THE LEVEL OF THE VERTICAL PARTICIPANT (THE HUB)

In this class, the conspiracy is orchestrated by the hub to protect or enhance its own market power. For example, in the diagram below, Distributor D acts as the hub of an agreement with upstream manufacturers A, B, and C. The distributor forms vertical agreements with each individual manufacturer (the "spokes") and facilitates the formation of agreements between each of the manufacturers (the "rim"). In this example, although the horizontal agreements are formed at the manufacturer level, the principal effect of the agreement is to restrict output, raise price, or degrade quality at the distributor level by foreclosing competitors (like Distributor P) from competing effectively with Distributor D.



Group boycotts like the one alleged in the well-known *Toys "R" Us v. FTC* matter are an example of this class of hub-and-spoke conspiracy. The retailer Toys "R" Us (TRU) was found to act as the hub by inducing its suppliers to agree restrict sales to low-priced warehouse clubs that were eroding TRU's market share.[6] A critical component of FTC's analysis of the conduct was that TRU did not just form vertical agreements with each of the toy manufacturers separately. Rather, FTC alleged that TRU facilitated horizontal agreements between the toy manufacturers, many of whom were alleged to have joined the boycott "on the condition that their competitors would do the same."[7] TRU's efforts to assure manufacturers that their competitors would also adhere to the boycott, thereby constituted the horizontal "rim."

Here, the competitive harm the court found was at the downstream retail level, benefiting the hub (TRU) to the detriment of rival low-priced warehouse clubs. FTC did not allege that the manufacturers, as members of the horizontal agreement, benefitted directly from the conspiracy, which required them to forego additional sales opportunities to low-priced warehouse clubs. Instead, the court found that their incentive to participate stemmed from avoiding punishment by TRU in the form of lost business or repayment requirements. The horizonal agreement served to mitigate the toy manufacturers' losses by ensuring that no individual toy manufacturer could gain an advantage by continuing to sell to the warehouse clubs.

6 *Toys "R" Us, Inc. v. FTC*, 221 F.3d 928, 932 (2000).

7 *Ibid.*

In this class of hub-and-spoke conspiracy, the incentive of the hub participant is typically clear from an economic perspective, but more nuanced questions arise relative to the incentives of the spoke participants:

- Why do the spoke participants agree to participate in this conspiracy?
- What role do the horizontal agreements play in the economic incentives of the spokes, relative to an alternative in which the hub simply formed a vertical agreement with each spoke separately?

A. Avoiding Punishment

The most common theory is that the bargaining power of the hub is so great that it can credibly threaten to punish any firm that does not comply (e.g. TRU refusing to carry a manufacturer's toys). The horizontal "rim" agreement serves to assure each spoke member that its rivals are also being hobbled, so it is not at a competitive disadvantage for complying. Under this theory, it must be the case that Distributor D has at its disposal a credible means of punishing each manufacturer that (1) ensures that a defecting Manufacturer A who chose to sell to a rival Distributor P would lose more from the punishment by Distributor D than it would gain from selling to Distributor P; (2) is consistent with Distributor D's own incentives, recognizing that by refusing to purchase from Manufacturer A would result in lost sales for Distributor D as well.

These requirements illustrate the fragility of this logic: the explanations underlying the formation of the vertical and horizontal agreements are in tension. On the one hand, the formation of the vertical agreements requires the hub's threat to be credible against all participants, including potentially large ones who might call the hub's bluff, knowing the hub would suffer substantial revenue losses from delisting a major supplier. On the other, the formation of the horizontal agreements suggests that the hub's threat alone is insufficient to incent the rim participants to agree. Otherwise, a series of vertical agreements between the hub and the supplier would incentivize each manufacturer not to sell to Distributor P. In view of this tension, the obvious question from an economic perspective is why the rim would not collectively resist the hub's demands, rather than coordinate acquiescence.

The TRU case illustrates this tension. The court accepted FTC's argument that TRU could credibly threaten even large toy manufacturers into compliance. From an economic perspective, the level of cooperation that the court found between TRU and the toy manufacturers is surprising if the only incentive the toy manufacturers had to participate was avoiding punishment. The upstream market in which toy manufacturers operated was concentrated and characterized by meaningful product differentiation between top toy brands. Under this industry structure, if TRU were to act on the alleged threat of dropping a major toy manufacturer's products, TRU itself would likely experience substantial losses, particularly associated with the most popular toy brands for which consumers might not readily purchase substitutes. These considerations raise questions about the credibility of TRU's threat as a primary incentive for toy manufacturers to participate in the conspiracy.

B. Rent-sharing

A second common theory is that the hub participant may share — directly or indirectly — the supercompetitive rents it obtains from the conspiracy with the facilitating rim participants. For example, if the conspiracy between Manufacturers A, B, and C and Distributor D allows Distributor D to foreclose a competitor, Distributor P, Distributor D might compensate Manufacturers A, B, and C with more favorable contract terms, such as a higher price for their products. For these more favorable terms to incentivize the manufacturers to participate in the conspiracy, it must be that the hub beneficiary is able to transfer enough of its supracompetitive rents to each of the facilitating manufacturers that they are better off participating in the conspiracy than defecting by selling to Distributor P.

Moreover, to the extent that Distributor P can destabilize the conspiracy by offering a payoff to manufacturers that defect, Distributor D must also compensate the manufacturers from any additional profit they might make from this payoff. The need to incentivize many rim participants thus dissipates some of the supracompetitive profits that the hub distributor makes from the agreement. An economically rational Distributor D would weigh the supracompetitive profits it could make from the conspiracy, after rent sharing with the facilitating rim, against the profits it would make in a counterfactual in which it did not attempt to exclude its rival Distributor P. In some cases, the rents associated with the alleged hub-and-spoke conspiracy may be insufficient to create a stable agreement.

While the court did not find that toy manufacturers in the TRU case shared in the alleged cartel rents, from an economic perspective, rent-sharing merits some consideration as an alternative explanation for the toy manufacturers alleged participation. As the court noted, low-price warehouse clubs offered toys to their customers at prices 25 percent lower than the prices offered by TRU in some cases.[8] The court concluded that documentary evidence in the case indicated that multiple toy manufacturers indicated their willingness to boycott these retailers if their competitors did so as well. These court findings are at least potentially consistent with an alternative explanation of their motivation for

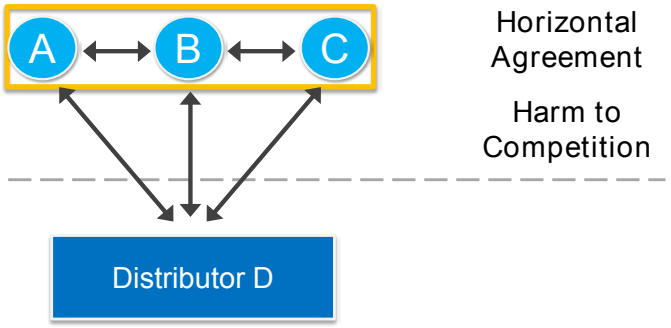
8 *Ibid.*

participating in the conspiracy: by participating in the group boycott, they may have avoided competition through one channel, club stores, which could have the effect of driving down prices across all channels. Under this alternative explanation, the group boycott harms competition at both the hub and rim level. We discuss Class Three conspiracies that harm competition in both the hub and spoke product markets in Section IV.

III. CLASS TWO – CONSPIRACY PRIMARILY INCREASES MARKET POWER AT THE LEVEL OF THE HORIZONTAL PARTICIPANTS (THE RIM)

In Class Two conspiracies, the horizontal competitors on the rim are the primary beneficiaries, and the hub acts as a facilitator. As shown in the figure, in this second class of hub-and-spoke conspiracy, Distributor D facilitates an agreement between Manufacturers A, B, and C that results in harm to competition at the manufacturer level. For example, the hub might be an upstream supplier that helps its downstream retailers fix resale prices, or it might be a downstream buyer that helps its upstream suppliers rig bids.

Hub-and-Spoke Conspiracy
Harming Competition at the Rim Level



There are a variety of alleged conspiracies that could fit this model. For example, flipping the diagram above so that the horizontal conspiracy is among downstream participants, a common example of a Class Two hub-and-spoke conspiracy is one in which a manufacturer's downstream retailers conspire to reduce intrabrand competition amongst themselves at the retail level and achieve that goal by convincing their common upstream manufacturer to impose a resale price maintenance policy or series of agreements.[9] Another example of a Class Two hub-and-spoke conspiracy is the alleged conspiracy in *In re Insurance Brokerage Antitrust Litigation*, in which downstream insurance brokers were alleged to have facilitated a bid rigging conspiracy among upstream insurance companies.[10] One insurance broker in particular was alleged to have conspired with insurance brokers in a "bid rotation" scheme. Specifically, the mortgage broker facilitator was alleged to have directed the insurer-conspirators to furnish "sham" bids to the broker in order to facilitate steering business to the incumbent insurer for renewal business, in exchange for reciprocal treatment, such that each incumbent insurer faced no actual competition for these customers.[11] The case settled before trial.

As illustrated by this case, in this class of hub-and-spoke conspiracy, the incentive of the rim participants is typically clear from an economic perspective, but more nuanced questions arise relative to the incentives of the hub participant:

- Why does the hub participant agree to facilitate this conspiracy?
- Given that economic incentives to form horizontal conspiracies can exist without a vertical participant, what role does the hub participant play in shaping rim participants' incentives?

In a Class Two conspiracy, the rim's incentive is clear — to earn cartel profits. The crucial economic question is why the hub would participate, especially if it means paying higher prices (if the hub is a buyer) or reducing final sales (if the hub is a sup-

9 See e.g. *Toledo Mack Sales & Serv., Inc. v. Mack Trucks, Inc.*, 530 F.3d 204 (3d Cir. 2008) (plaintiffs allege that purpose of manufacturer's vertical resale price maintenance agreement is to support illegal horizontal agreements between competing dealers).

10 *In re Insurance Brokerage Antitrust Litig.*, 618 F.3d 300, 311-312, 327-347 (3d Cir. 2010) (affirming dismissal of most claims alleging broker-centered hub-and-spoke conspiracies, but not those based on facilitated bid rigging).

11 *In re Insurance Brokerage Antitrust Litig.*, 618 F.3d 300, 311-312, 327-347.

plier). The answer must be that the hub is compensated. As in a Class One conspiracy, that compensation may run the gamut from *avoiding punishment* to *rent-sharing.*

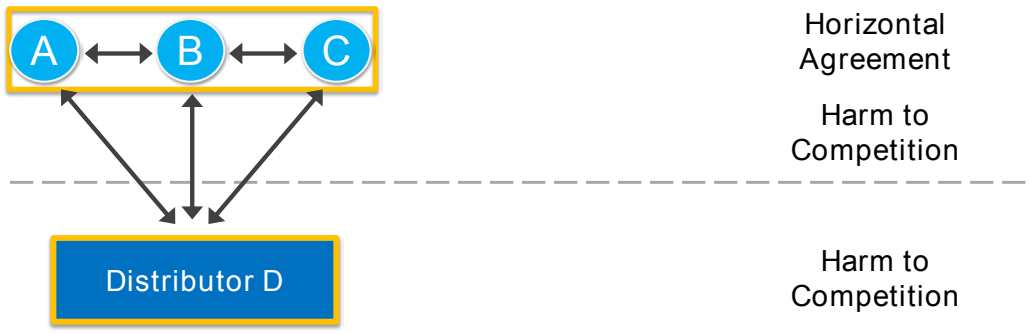
A critical element in establishing the hub's incentive to participate is that the hub must face competition. If Distributor D were a monopolist, the rim participants' ability to credibly threaten the hub with lost sales or other forms of retaliation would be hampered. Manufacturers A, B, and C might still attempt to threaten Distributor D with self-supply. However, the fact they initially elected to distribute through Distributor D indicates the Manufacturers' efficiency in distributing their products themselves would be lower than that of Distributor D, potentially rendering the threat less credible. Nor could the manufacturers incentivize Distributor D through rent-sharing, due to the principle of "one monopoly rent." That is, a monopolist Distributor D would already charge the highest price for its distribution services that is profit-maximizing in the market. Colluding in a scheme that would raise prices further (by increasing the distributor's input costs) would only decrease rents to the monopolist.

In *In re Insurance Brokerage Antitrust Litigation*, the mortgage broker's economic incentive to participate was alleged to come from rent-sharing: contingent commissions paid to the mortgage broker by its insurance company co-conspirators.[12] Of note, Plaintiffs and the court described the mortgage broker, not the insurers, as the motive force behind the alleged conspiracy, alluding to its alleged negotiating power in a concentrated insurance brokerage market.[13] These allegations may point to a third class of alleged hub-and-spoke conspiracy, in which the conspiracy is designed to benefit conspirators at both levels.

IV. CLASS THREE – CONSPIRACY INCREASES MARKET POWER AT BOTH LEVELS

The third class of hub-and-spoke conspiracy involves a quid pro quo, where the conspiracy is designed to benefit participants at both the hub and rim levels. For example, Distributor D (the hub) might facilitate a price-fixing conspiracy among Manufacturers A, B, and C (the rim). In exchange for its role, the suppliers agree to charge Distributor P (and any other rivals of the hub) even higher prices, thus giving the hub a competitive advantage in its own product market. This structure effectively shares the cartel profits between the hub and the rim, harming competition at both levels. These conspiracies are closely related to Class Two arrangements that incentivize the hub through rent-sharing, as they represent a potentially effective means of sharing the cartel rents among all participants.

Hub-and-Spoke Conspiracy
Harming Competition at the Rim and Hub Levels



Class Three conspiracies have the most straightforward economic logic, as all participants gain an anticompetitive advantage. The hub helps the rim create a cartel, and in return, the rim helps the hub weaken its own rivals. This is a clear exchange of anticompetitive favors, where the monopoly profits from one market are used to finance the acquisition of market power in another. The arrangement is potentially stable if other standard conditions for cartel stability are met, including the ability to detect and punish deviators and that the shared gains outweigh the risks of detection.

An example of a Class Three conspiracy is in *Columbus Drywall v. Masco*, in which plaintiffs alleged that, during a time of decreased demand and excess supply, downstream fiberglass insulation contractor Masco acted as a hub in facilitating a coordinated price

12 *In re Insurance Brokerage Antitrust Litig.*, 618 F.3d 300, 311-312, 327-347 (3d Cir. 2010).

13 *In re Insurance Brokerage Antitrust Litig.*, 618 F.3d 300, 311-312, 327-347 (3d Cir. 2010).

increase by upstream manufacturers. The complaint alleged that Masco facilitated the conspiracy in exchange for the manufacturers' agreement to maintain a spread between prices charged to the hub and higher prices charged to rival contractors (the case settled before trial).[14]

V. CLASS FOUR – CONSPIRACY THROUGH A COMMON SOFTWARE ALGORITHM INCREASES MARKET POWER AT THE LEVEL OF THE HORIZONTAL PARTICIPANTS (THE RIM)

A fourth and final class of conspiracy has arisen recently through multiple matters, involving both enforcement agencies and private plaintiffs, in which the central allegation is that a provider of algorithmic pricing and inventory management software has facilitated an exchange of competitively-sensitive information between competitors, and/or has facilitated coordination on price between competitors (rental property managers in the various *RealPage* and *Yardi* matters and hoteliers in the *Cornish-Adebiyi* and *Gibson* matters). Another distinct but thematically related case is *Agri Stats*, in which the data company Agri Stats is alleged to coordinate the exchange of competitively-sensitive information between competitors in the meat processing industry through its industry reports.[15] The specifics of the allegations in these matters vary, and do not necessarily include all the elements of a hub-and-spoke conspiracy. For example, in some matters, the alleged conduct is limited to information exchange that distorts the competitive process, while others allege a conspiracy to fix prices.[16] Some allege explicit collusion at the rim level, while others do not. We abstract from these differences in the following discussion to identify some common economic themes.

The allegations in these cases have features in common with Class Two conspiracies discussed above: in which the hub coordinates a conspiracy in which the rim participants are the primary beneficiaries. However, in Class Four, the "hub" is a service provider that offers a core function (e.g. assisting clients in managing pricing and inventory) that is alleged to knowingly facilitate collusion or to otherwise distort the competitive process. As discussed below, an economic analysis of the hub's incentive to participate in the alleged conspiracy looks somewhat different when the hub's core service involves a providing outsourced pricing recommendations, as opposed to providing another good or service as an input to which the alleged role as cartel coordinator is incidental.

For example, in *Gibson et al. v. Cendyn Group, LLC, et al.*, Plaintiffs alleged that hotel operators on the Las Vegas Strip and Cendyn engaged in a hub and spoke conspiracy in which competing hotel operators (the horizontal competitors) used Cendyn's software platform (the hub) to artificially inflate hotel room prices.[17] The complaint alleged that hotel operators provided Cendyn with competitively sensitive data on pricing and availability, and Cendyn's software generated pricing recommendations that resulted in supracompetitive prices for hotel rooms.[18] Plaintiffs further alleged that hotel operators delegated their pricing authority to the algorithm, and that Cendyn attempted to enforce adoption of its recommendations through product design decisions that make it much easier to accept than to decline price recommendations using its software.[19] The complaint alleged harm at the level of the horizontal participants (the hotel operators), while the hub (Cendyn) served as the vehicle for the information exchange and price coordination that underpinned the alleged collusion.[20]

Many of these cases remain active, though some have been dismissed or are in the process of settlement as of the time of writing. The existence of agreements at both levels of the hub-and-spoke agreement is a contested issue in many. For example, the *Gibson* matter involving Las Vegas hotel operators and the similar *Cornish-Adebiyi* matter involving Atlantic City hotel operators were dismissed because the court found in each case that Plaintiffs had failed to show that hotel operators' use of the pricing software served as evidence of either horizontal or vertical agreements as part of the alleged conspiracy, rather than merely parallel conduct.[21]

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14 *Columbus Drywall & Insulation, Inc. v. Masco Corp.*, 2009 U.S. Dist. LEXIS 30937 (N.D. Ga. 2009).

15 *United States et al. v. Agri Stats*, No. 0:23-cv-03009-JRT-JFD (D. Minn. Nov. 15, 2023).

16 For example, see *DOJ Introduces New Twist in Algorithmic Collusion Cases*, Holland & Knight (Aug. 26, 2024), https://www.hklaw.com/en/insights/publications/2024/08/doj-introduces-new-twist-in-algorithmic-collusion-cases.

17 Amended Complaint, *Gibson v. Cendyn Group LLC*, No. 2:23-CV-00140-MMD-DJA (D. Nev. May 8, 2024), ¶¶ 2, 19.

18 *Ibid.* at ¶¶ 12–17.

19 *Ibid.* at ¶¶ 6–8.

20 *Ibid.* at ¶ 12.

21 *Cornish-Adebiyi, et al. v. Caesars Entertainment, Inc., et al.*, No. 1:23-CV-02536-KMW-EAP (D. N.J. Sept. 30, 2024); *Gibson v. Cendyn Group LLC*, No. 2:23-CV-00140-MMD-DJA (D. Nev. May 8, 2024).

As in Class Two hub-and-spoke conspiracies, the incentive of the rim participants is fairly clear from an economic perspective, but more nuanced questions arise with respect to the incentives of the hub:

- Why does the hub participant agree to facilitate this conspiracy?
- Given that economic incentives to form horizontal conspiracies can exist without a vertical participant, what role does the vertical participant play in shaping horizontal participants' incentives?

In typical hub-and-spoke conspiracy, as discussed throughout this article, the vertical (hub) participant has incentives with respect to the outcomes sought by the conspiracy that are potentially directly adverse to those of the horizontal (rim) participants. Thus, a key economic question is how the cartel is organized to align the incentives of all participants. A pricing software provider does not necessarily have an economic incentive that is directly adverse to that of the rim participants in the same way that a distributor's incentives with respect to the price charged by upstream manufacturers may be directly adverse to those of the manufacturers themselves. However, it does not necessarily follow that the software provider has an incentive to develop software that increases its clients' profits by facilitating collusion. As Harrington (2022) shows, when software providers compete for adoption, or when firms have the option to self-supply (i.e. to set their own prices in-house), the incentive of the software provider to develop software that implements a collusive agreement, as well as the incentive of an incremental customer to subscribe to such a service, require careful economic analysis.[22]

If the software provider's compensation is not tied to its performance in driving incremental profits (e.g. a subscription fee model), then the software provider will have a weak incentive to organize such a conspiracy. In that circumstance, the software provider competes for adoption and increases its profit by signing up as many customers as possible in competition with rivals. A customer selecting between competing software providers (or its outside option — pricing its own products) has an incentive to choose whichever option it expects to deliver the largest increase in profits. Competition for marginal customer thus creates an incentive for the software provider to undercut supracompetitive pricing. Pricing software providers might instead choose to compete for client subscriptions by, for example, enhancing the client's ability to respond to high-frequency changes in demand, thereby enhancing the client's profits through a channel that does not give rise to the same incentive to undercut.[23]

VI. CONCLUSION

Hub-and-spoke conspiracies are not a monolithic category. Their economic logic varies dramatically, from a powerful hub coercing its partners (Class One) to a cartel of competitors using a hub as a cartel management tool (Class Two), to a complex arrangement in which a cartel of competitors shares rents by reducing competition at more than one level of the supply chain (Class Three). Finally, recent cases involving pricing software firms alleged to act as hubs have suggested a possible new class of hub-and-spoke agreements (Class Four) in which a service provider outside the supply chain acts as the facilitator of the conspiracy. For courts and practitioners, understanding the underlying economic incentives is paramount to evaluating the alleged conspiracy.

22 Joseph E. Harrington, Jr. (2022) The Effect of Outsourcing Pricing Algorithms on Market Competition. Management Science 68(9):6889-6906.

23 Joseph E. Harrington, Jr. (2022) The Effect of Outsourcing Pricing Algorithms on Market Competition. Management Science 68(9):6889-6906.